AEROSPACE FACTS AND FIGURES 1981/82

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FOREWORD

For the U.S. aerospace industry, 1980 was a year of solid growth in virtually all categories of activity.

Sales reached a new record level, which—even allowing for the high rate of inflation—reflected an excellent year overall. In terms of inflation-adjusted constant dollars, sales in 1980 topped those of every year since 1969.

Measured as a percentage of sales, earnings dipped well below the all-time high recorded a year earlier. Still, for the fourth consecutive year, the profit rate was above 4 percent. The general improvement in profit levels is encouraging since future capital needs of the industry will be considerable if it is to fund future generations of commercial aircraft and the expected buildup in the defense sector.

Once again, we are gratified by the industry's achievements in the international marketplace, which underscore the importance to the U.S. economy of high-value, high-technology aerospace exports. The industry recorded its highest-ever levels of export sales and trade balance, thus offsetting to a great extent the lagging U.S. performance in other areas of international trade. The aerospace trade balance, best among U.S. manufacturing industries, is particularly impressive in view of growing foreign competition and a resultant significant increase in aerospace imports.

During 1980, the industry's total backlog increased by more than 20 percent, with gains in all major categories. This assures continuing high activity levels for immediate future years.

The outlook for the longer term is similarly bright. The industry's defense production, which declined as a percentage of the total during the 1970s, seems headed for a new upturn in light of the Administration's projected defense outlays for coming years.

Despite the debut of the Space Shuttle, there is little immediate prospect for expansion of the industry's workload in development and fabrication of civil space systems. However, funding for military space development has been increasing steadily in recent years, to the point where civil and defense space outlays are now almost equal. Moderate growth is expected in the space sector during the first half of this decade. With the expanded capability the Shuttle affords for both civil and defense space operations, space activity could increase significantly in the latter part of the decade.

While deliveries of commercial transports in 1981 are expected to be fewer than in 1980, the large backlog of orders indicates a continuing high level of production in the near-term. The financial problems of the world's airlines have slowed the flow of orders, but the airlines' need for new and replacement aircraft has not changed; projections show a world transport market of about $125 billion over the next 10 years. Given expected improvement in the airlines' financial status, and consequent resumption of earlier-contemplated re-equipment plans, transport manufacturing activity may go well beyond its current level.

In summary, the year was a good one for aerospace. The strong performance of sales and exports and record backlog, along with excellent prospects for the commercial transport and defense sectors, hold out the promise of continued health and growth for the industry.

Karl G. Harr, Jr.
President
Aerospace Industries Association

AEROSPACE SUMMARY

The aerospace industry closed out the first year of the new decade on a high note, recording new statistical peaks in sales, backlog, exports and contribution to the U.S. trade balance. Much of the statistical growth, of course, was due to the high U.S. inflation rate. However, there was also substantial *real* growth, as gains in many categories exceeded the nine percent inflation rate by wide margins. Sales, for example, increased almost 19 percent, backlog more than 20 percent and exports more than 32 percent.

Here is a breakdown of the industry's 1980 performance:

Sales. Total sales amounted to $53.3 billion, an increase of $8.4 billion over 1979. Most of the increase—more than $5 billion—was due to a sharp boost in aircraft sales, but there were gains in all categories.

Aerospace industry sales as a percentage of the Gross National Product increased from 1.9 percent in 1979 to two percent in 1980. In relation to total sales of all U.S. manufacturing industries, aerospace sales amounted to three percent; the figure compares with 2.7 percent in the previous year.

Profit. The industry's net profit after taxes, measured as a percentage of sales, was 4.2 percent. This represented a substantial drop from the five percent recorded in the previous year. A major factor in the reduced profit rate was high interest on borrowings necessary to finance new plant and equipment expenditures at a time when such expenditures were at their highest-ever level. As in previous years, the aerospace profit remained well below the average for all U.S. manufacturing corporations, which was 4.9 percent in 1980.

Backlog. Once again—as in the previous year—the industry's backlog climbed, dramatically. At year-end 1980, orders on the books amounted to more than $95 billion, up almost $17 billion over year-end 1979. The backlog included $53.6 billion in non-government orders and $41.5 billion in government work.

Following the traditional pattern, orders for aircraft—including engines and parts—constituted the principal element of the backlog—$59.5 billion or more than 62 percent. There were also major gains in orders for non-aerospace products produced by manufacturers, and for "other aerospace," a category which includes conversions, modifications, and ground support equipment, as well as basic and applied research, and design and development. A moderate increase was recorded in missile/space backlog.

Civil Aircraft Production. In 1980, shipments of civil aircraft were down almost 5,000 units below the level of the previous year, but the dollar value of shipments increased substantially, from $10.6 billion in 1979 to $13.1 billion in 1980. A marked decline in general aviation aircraft deliveries reduced total civil aircraft shipments to 13,634 units, down from 18,450 in 1979.

As is generally the case, the bulk of the dollar value of 1980 shipments was in commercial transports–$9.9 billion or more than 75 percent of the total; the amount represents an increase of $1.9 billion over 1979 sales. The industry delivered 387 transports, 11 more than in 1979. In both dollar value and numbers, gains were far below those of the previous year.

General aviation plane shipments totaled 11,881, the lowest level since 1972; the figure compares with 17,055 in 1979. However, the value of shipments increased by some $300 million, to $2.5 billion. The major portion of the production drop was in relatively low-value single-engine aircraft, an area severely impacted by the state of the U.S. economy, fuel costs, and, in particular, high interest rates. But the industry delivered 330 jet aircraft (up 14 percent) and 795 turboprops (up 25 percent). Increases in these higher-value categories more than offset lower single-engine sales.

Civil helicopter production continued the upward trend in evidence since 1976. The industry's rotary-wing segment produced 1,366 civil helicopters, 347 more than in 1979. Dollar value increased from $403 million in 1979 to $656 million in 1980.

Military Aircraft Production. The declining trend of earlier years was

reversed in 1980 as military aircraft production increased in number of deliveries and in dollar value. The Department of Defense accepted 606 aircraft for operation by the U.S. military services, compared with 531 in 1979. The Air Force led in acceptances with 359 aircraft, 48 more than in the previous year. Army acceptances totaled 160, up 43 from 1979, and deliveries to the Navy declined from 103 units in 1979 to only 87 in 1980.

The military services also accepted 194 aircraft—nine fewer than in 1979—for delivery to foreign governments under Foreign Military Sales and Military Assistance Programs. Total value of all acceptances—including aircraft for both U.S. and foreign use—was $5.8 billion, up $300 million over 1979.

The industry also produced 228 military-type aircraft which were exported commercially on a direct manufacturer-to-foreign government basis. This brought the total military aircraft production for 1980 to 1,028 units, compared with 837 in 1979.

Missile Programs. Overall sales of missile systems, including both production and R&D work, amounted to $6.7 billion in 1980. This compares with $5.9 billion in 1979 and represents an increase of 13.6 percent.

Excluding funding for research, development, test and evaluation, sales of missile systems, parts and propulsion units totaled $4.5 billion, down from $4.7 billion in 1979. Backlog, more than $7 billion at the end of 1980, was $1 billion higher than at the end of the previous year.

Space Programs. Combined sales of civil and military space vehicle systems, excluding propulsion units, amounted to $3.3 billion in 1980. The figure is not directly comparable to 1979's $2.5 billion due to a change in statistical reporting procedures in which the 1980 total includes, for the first time, sales to customers other than U.S. government agencies. In 1980, sales of space vehicle systems accounted for six percent of the industry's total sales. Civil space sales, at $1.7 billion, continued to lead military sales ($1.5 billion), but the gap narrowed during the year.

Research and Development. Aerospace industry expenditures for industrial research and development, including both government-sponsored and company-funded effort, declined slightly, from $8.5 billion in 1979 to $8.3 billion in 1980. The decline was contrary to a national trend in which R&D outlays for most U.S. industries increased substantially. Aerospace, which led all industries in 1979 expenditures, slipped to second place behind the electrical machinery industry. Estimates for 1981 show that aerospace R&D expenditures will increase by roughly 10 percent to $9.1 billion.

Federal outlays for R&D, a general indicator of industry activity levels, will increase in Fiscal Year 1981. In areas primarily affecting the aerospace industry, Department of Defense outlays are estimated at $15.6 billion (up more than 15 percent).

NASA R&D funding for FY 81 is $5.1 billion (up nine percent) and outlays for the Department of Energy are estimated at $5 billion (up seven percent). Federal FY 1981 outlays for aeronautical R&D will decline across the board; the total of $2.8 billion is $123 million less than in the previous year.

Non-aerospace Sales. AIA estimates of sales of non-aerospace products and services by aerospace manufacturers showed continued growth and a new peak level of $9.4 billion, up from $7.7 billion in 1979. The 1980 figure represents 17.6 percent of total industry sales; a decade earlier it constituted 10.6 percent.

Foreign Trade. Once again setting new records for export sales and net trade balance, the aerospace industry made a significant contribution to the national economy by offsetting U.S. deficits in other areas of international trade. At $15.5 billion, aerospace exports were almost $4 billion above the previous peak level of $11.7 billion in 1979; they represented 7.2 percent of all U.S. merchandise exports. With a trade surplus of $12 billion, aerospace again led all U.S. manufacturing industries in positive contribution to the nation's trade balance.

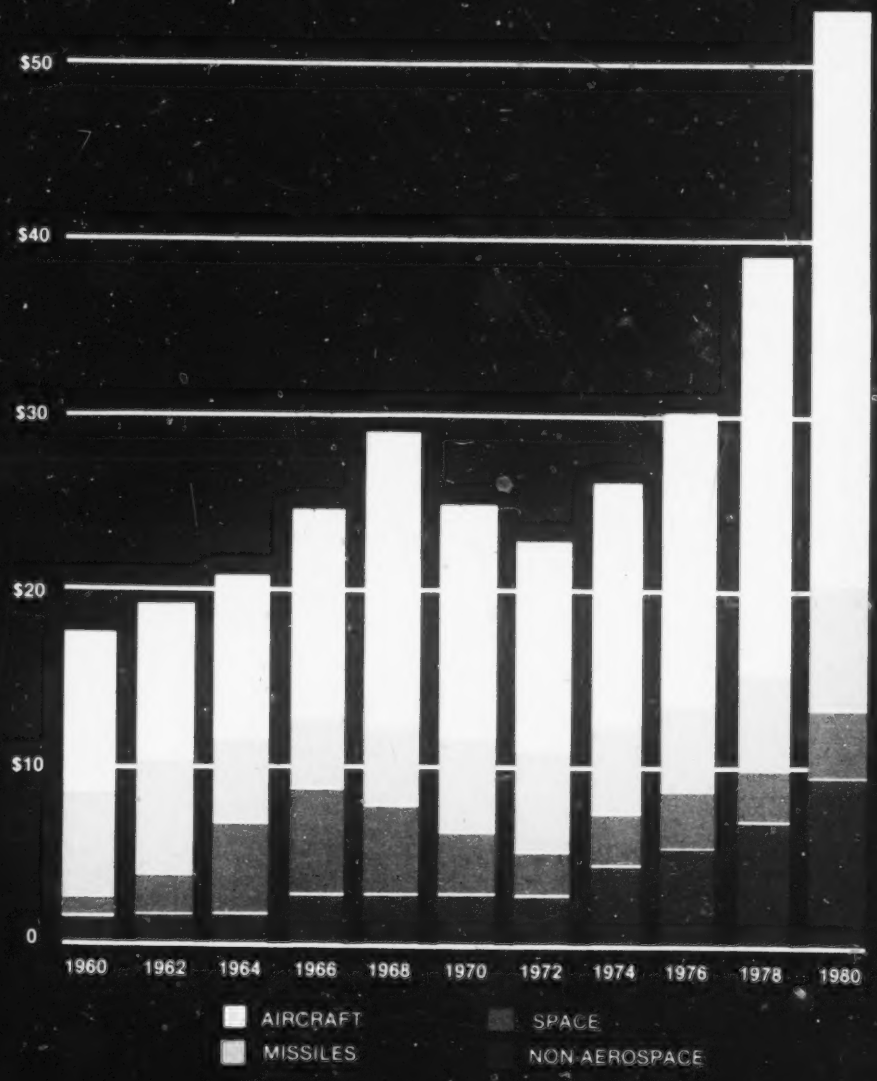
This trade surplus was achieved despite a sharp increase in aerospace imports that reflected strong and growing competition from foreign manufacturers. Imports totaled $3.6 billion, more than double the 1979 level. Some of the increase is attributable to changes in tariff schedules and reporting categories, but most of it stemmed from further penetration by foreign plane builders of the U.S. civil aircraft market, particularly in sales of commuter-type aircraft.

Civil aerospace exports, at $13.2 billion, represented more than 85 percent of the 1980 total. As in previous years, sales of commercial transport aircraft constituted the greatest dollar value among exports; sales of transports abroad totaled $6.7 billion, up from $5 billion in 1979. Military exports increased moderately, from $2 billion in 1979 to $2.3 billion in 1980.

Employment. Sustained activity in commercial transport manufacture was the principal factor in 1980 continuance of the upward trend in aerospace industry employment. At year-end, the industry's labor force numbered 1,218,000, an 11-year high. Average employment for the year was 1,190,000. The latter figure compares with 1,115,000 in 1979 and represents an increase during the year of 6.7 percent. That increase, however, was lower than in the previous two years, when relative annual increases of nine and 14 percent were recorded.

The number of production workers increased 6.6 percent, from 563,000 in 1979 to 600,000—roughly half the total industry labor force—in 1980. As in previous years, most production workers—357,000 or almost 60 percent—were engaged in manufacture of aircraft and related equipment. Average hourly earnings for these aircraft production workers amounted to $9.27, up more than 12 percent over the previous year's $8.26. Average weekly earnings increased somewhat less from $351 to $389.

AEROSPACE INDUSTRY SALES BY PRODUCT GROUP
(Billions of Dollars)



AEROSPACE INDUSTRY SALES BY PRODUCT GROUP

Calendar Years 1955–1980
(Millions of Dollars)

Year	TOTAL Sales	Product Group			
		Aircraft	Missiles	Space	Non-Aerospace
1955	$12,411	$ 9,781	$1,513	$ —	$1,117
1956	13,946	10,485	2,206	—	1,255
1957	15,858	11,398	3,033	—	1,427
1958	16,065	10,582	4,036	1	1,446
1959	16,640	9,714	5,042	386	1,498
1960	17,326	9,127	5,762	878	1,559
1961	17,997	8,847	6,266	1,264	1,620
1962	19,162	8,944	6,311	2,182	1,725
1963	20,134	8,527	6,003	3,774	1,830
1964	20,594	6,911	5,242	4,720	1,721
1965	20,670	9,747	3,626	5,329	1,968
1966	24,610	11,951	4,053	5,969	2,637
1967	27,267	14,981	4,417	5,290	2,579
1968	28,977	16,578	4,719	5,131	2,549
1969	26,149	14,097	5,058	4,295	2,699
1970	24,904	13,293	5,379	3,588	2,644
1971	22,154	11,442	5,016	3,171	2,523
1972	22,816	11,866	5,217	3,089	2,646
1973	24,809	13,338	5,177	2,951	3,343
1974	26,400	14,050	5,187	3,096	4,067
1975	28,373	15,227	5,126	3,228	4,792
1976	30,116	16,426	4,936	3,386	5,370
1977	32,294	17,388	5,452	3,422	6,032
1978	39,045	23,846	5,237	3,147	6,813
1979	44,970	27,937	5,677	3,441	7,715
1980	53,344	33,116	6,676	4,119	9,433

AEROSPACE INDUSTRY SALES BY CUSTOMER

Calendar Years 1955–1980
(Millions of Dollars)

Year	TOTAL Sales	Aerospace Products and Services			Non-Aerospace Products and Services
		U.S. Government		Other Customers	
		Department of Defense	NASA and Other Agencies		
1955	$12,411	$10,508	$ —	$ 786	$1,117
1956	13,946	11,525	—	1,166	1,255
1957	15,858	12,833	—	1,598	1,427
1958	16,065	13,246	1	1,372	1,446
1959	16,640	13,171	130	1,841	1,498
1960	17,326	13,196	363	2,208	1,559
1961	17,997	13,871	630	1,876	1,620
1962	19,162	14,331	1,334	1,772	1,725
1963	20,134	14,191	2,628	1,485	1,830
1964	20,594	13,218	3,635	2,020	1,721
1965	20,670	11,396	4,490	2,816	1,968
1966	24,610	13,284	5,026	3,663	2,637
1967	27,267	15,855	4,201	4,632	2,579
1968	28,977	16,573	3,938	5,917	2,549
1969	26,149	15,771	3,337	4,342	2,699
1970	24,904	14,643	2,974	4,643	2,644
1971	22,154	12,584	2,745	4,302	2,523
1972	22,818	13,295	2,608	4,269	2,646
1973	24,809	12,886	2,394	6,186	3,343
1974	26,400	12,650	2,527	7,156	4,067
1975	28,373	13,127	2,727	7,727	4,792
1976	30,118	13,402	2,815	8,531	5,370
1977	32,294	14,389	2,880	8,993	6,032
1978r	39,045	15,704	3,147	13,381	6,813
1979r	44,970	16,603	3,441	17,211	7,715
1980	53,344	19,516	4,119	20,276	9,433

Source: Aerospace Industries Association.
NOTE: For an explanation of "Aerospace Sales," see the Glossary.

SALES AND BACKLOG OF MAJOR AEROSPACE COMPANIES AS REPORTED BY THE BUREAU OF THE CENSUS

Calendar Years 1968–1980
(Millions of Dollars)

Year	GRAND TOTAL	TOTAL		Aircraft, Engines, and Parts		Missiles & Space Incl. Pro-pulsion	Other Aerospace		Non-Aero-space
		U.S. Gov't.	Other	U.S. Gov't.	Other		U.S. Gov't.	Other	
SALES									
1968	$25,592	$16,635	$ 8,957	$ 7,411	$ 6,439	$6,076	$2,077	$1,040	$2,549
1969	24,648	16,560	8,088	7,161	5,603	5,660	2,539	986	2,699
1970	24,752	16,407	8,345	7,586	5,880	5,422	2,324	896	2,644
1971	21,679	14,114	7,565	6,313	5,079	4,971	1,909	884	2,523
1972	21,499	13,492	8,007	4,954	5,199	5,598	2,067	1,035	2,646
1973	24,305	14,431	9,874	5,539	6,739	5,580	2,103	1,001	3,343
1974	26,849	15,196	11,653	5,982	7,560	5,854	2,101	1,285	4,067
1975	29,473	17,314	12,159	6,859	7,797	6,310	2,070	1,645	4,792
1976	31,328	19,083	12,245	8,314	7,622	5,880	2,368	1,833	5,311
1977	33,315	20,704	12,611	8,848	7,530	5,775	2,839	2,219	6,104
1978	37,968	21,888	16,080	8,724	10,581	6,380[a]	3,363	2,107[a]	6,813
1979[r]	46,173	23,229	22,944	8,649	16,023	7,197	3,930	2,659	7,715
1980	57,608	26,141	31,467	9,496	19,432	7,783	5,881	2,757	12,259
BACKLOG—AS OF DECEMBER 31									
1968	$30,749	$16,343	$14,406	$ 8,150	$12,409	$5,083	$1,851	$ 983	$2,273
1969	28,297	14,298	13,999	7,089	12,099	4,338	2,001	880	1,890
1970	24,705	12,882	11,823	5,913	9,800	4,522	1,986	805	1,679
1971	24,579	13,997	10,582	6,221	8,059	4,780	2,232	1,042	2,245
1972	26,922	15,322	11,600	7,027	8,605	5,272	2,018	972	3,028
1973	29,661	16,695	12,966	7,815	8,550	5,670	1,819	1,078	4,729
1974	35,516	20,889	14,627	9,789	9,602	6,643	1,926	1,665	5,891
1975	35,038	22,168	12,870	10,751	8,141	6,415	1,983	2,088	5,660
1976	39,702	24,141	15,561	11,950	8,929	6,286	2,046	3,496	6,995
1977	45,309	26,119	19,190	12,471	12,592	6,743	2,761	3,447	7,295
1978	57,160	30,223	26,937	14,897	18,972	7,557	4,029	3,668	8,037
1979[r]	78,259	36,136	42,123	17,316	33,168	7,388	5,613	5,112	9,662
1980	95,149	41,502	53,647	18,927	40,605	8,877	8,115	5,080	13,545

Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quarterly)
a AIA estimate based on MQ37D data.
r Revised.

AEROSPACE SALES AND THE NATIONAL ECONOMY

Calendar Years 1960–1980
(Billions of Dollars)

Year	Gross National Product[r]	Sales			Aerospace Sales as Percent of		
		Manufacturing Industries	Durable Goods Industries	Aerospace Industry	GNP	Manufacturing Industries	Durable Goods Industries
1960	$ 506.5	$ 345.7	$ 173.9	$ 17.3	3.4%	5.0%	9.9%
1961	524.6	356.4	175.2	18.0	3.4	5.1	10.3
1962	565.0	389.9	195.5	19.2	3.4	4.9	9.8
1963	596.7	412.7	209.0	20.1	3.4	4.9	9.6
1964	637.7	443.1	226.3	20.6	3.2	4.6	9.1
1965	691.1	492.2	257.0	20.7	3.0	4.2	8.1
1966	756.0	554.2	291.7	24.6	3.3	4.4	8.4
1967	799.6	575.4	300.6	27.3	3.4	4.7	9.1
1968	873.4	631.9	335.5	29.0	3.3	4.6	8.6
1969	944.0	694.6	366.5	26.1	2.8	3.8	7.1
1970	992.7	708.8	363.1	24.9	2.5	3.5	6.9
1971	1,077.6	751.4	382.5	22.2	2.1	3.0	5.8
1972	1,185.9	849.5	435.8	22.8	1.9	2.7	5.2
1973	1,326.4	1,017.2	527.3	24.8	1.9	2.4	4.7
1974	1,434.2	1,060.7	529.0	26.4	1.8[r]	2.5	5.0
1975	1,549.2	1,046.7	526.9	28.4	1.8[r]	2.7	5.4
1976	1,718.0	1,178.0	604.7	30.1[r]	1.8	2.6	5.0
1977	1,918.0	1,335.1	699.2	32.3	1.7	2.4	4.6[r]
1978	2,156.1	1,496.6	798.1	39.0[r]	1.8	2.6[r]	4.9[r]
1979	2,413.9	1,692.0[r]	887.8[r]	45.0	1.9	2.7	5.1
1980	2,626.1	1,798.5	902.7	53.3	2.0	3.0	5.9

Source: Gross National Product: "Economic Report of the President," (Annually). Sales of Manufacturing and Durable Goods Industries: Bureau of Economic Analysis, "Survey of Current Business," (Monthly). Aerospace Sales: Aerospace Industries Association.

NOTE: For an explanation of "Aerospace Sales" see the Glossary.

r Revised.

AEROSPACE SALES AND THE NATIONAL ECONOMY IN CONSTANT DOLLARS[r]

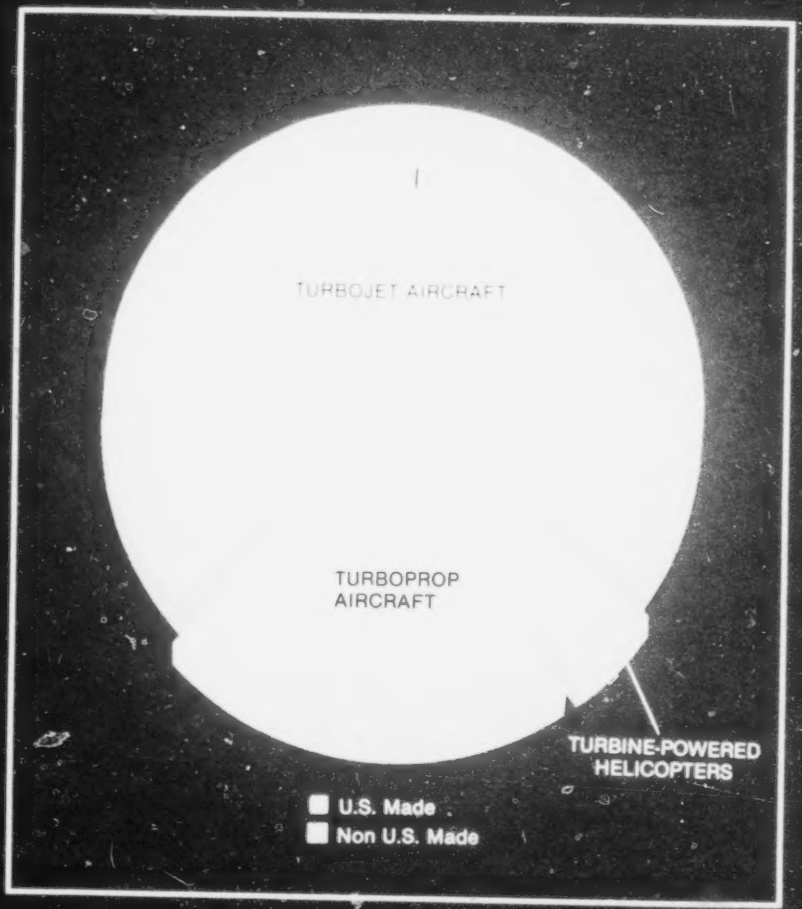
Calendar Years 1960–1980
(Billions of 1972 Dollars)

Year	Gross National Product	Sales			GNP Implicit Price Deflator 1972 = 100
		Manufacturing Industries	Durable Goods Industries	Aerospace Industry	
1960	$ 737.2	$ 503.2	$ 253.1	$ 25.2	68.70
1961	756.6	514.1	252.7	26.0	69.33
1962	800.3	522.2	276.9	27.2	70.61
1963	832.5	575.8	291.6	28.0	71.67
1964	876.4	608.9	311.0	28.3	72.77
1965	929.3	661.9	345.6	27.8	74.36
1966	984.8	722.0	380.0	32.0	76.76
1967	1,011.4	727.8	380.2	34.5	79.06
1968	1,058.1	765.6	406.5	35.1	82.54
1969	1,087.6	800.3	422.3	30.1	86.79
1970	1,085.6	775.1	397.0	27.2	91.45
1971	1,122.4	782.6	398.4	23.1	96.01
1972	1,185.9	849.5	435.8	22.8	100.00
1973	1,255.0	962.4	498.9	23.5	105.69
1974	1,248.0	923.0	460.3	23.0	114.92
1975	1,233.9	833.6	419.6	22.6	125.56
1976	1,300.4	891.7	457.7	22.8	132.11
1977	1,371.7	954.8	500.0	23.1	139.83
1978	1,436.9	997.4	531.9	26.0	150.05
1979	1,483.0	1,039.5	545.4	27.6	162.77
1980	1,480.7	1,014.0	509.0	30.1	177.36

Source: Deflator Series: "Economic Report of the President," (Annually); "Survey of Current Business," (Monthly).

r All constant dollar sales data recalculated because of revisions in GNP and GNP Implicit Price Deflator levels.

U.S. MANUFACTURED TURBINE-ENGINED AIRCRAFT IN THE WORLD AIRLINE FLEET, 1980



Source: [illegible] "All World Survey, 1981"

ANNUAL AVERAGE EMPLOYMENT IN ALL MANUFACTURING, DURABLE GOODS AND AEROSPACE INDUSTRIES

Calendar Years 1961–1980
(Thousands of Employees)

Year	All Manufacturing Industries	Durable Goods Industries	Aerospace Industry TOTAL	Aerospace Industry As Percent of All Manufacturing	Aerospace Industry As Percent of Durable Goods
1961	16,326	9,070	1,178	7.2%	13.0%
1962	16,853	9,480	1,270	7.5	13.4
1963	16,995	9,616	1,267	7.5	13.2
1964	17,274	9,816	1,209	7.0	12.3
1965	18,062	10,406	1,175	6.5	11.3
1966	19,214	11,284	1,375	7.2	12.2
1967	19,447	11,439	1,484	7.6	13.0
1968	19,781	11,626	1,502	7.6	12.9
1969	20,167	11,895	1,402	7.0	11.8
1970	19,349	11,195	1,166	6.0	10.4
1971	18,529	10,565	951	5.1	9.0
1972	19,151	11,049	912	4.8	8.3
1973	20,154	11,891	956	4.7	8.0
1974	20,077	11,925	982	4.9	8.2
1975	18,323	10,688	941	5.1	8.8
1976	18,997	11,077	896	4.7	8.1
1977	19,682	11,597	893	4.5	7.7
1978	20,505	12,274	977	4.8	8.0
1979	21,062	12,772	1,115	5.3	8.7
1980	20,361	12,215	1,190	5.8	9.7

Source: Manufacturing and Durable Goods Employment from Bureau of Labor Statistics, "Employment and Earnings" (Monthly); Aerospace Employment from Aerospace Industries Association estimates based on "Employment and Earnings," Bureau of Labor Statistics.

NOTE: For explanation of "Aerospace Employment," see the Glossary.

r Revised.

ANNUAL AVERAGE EMPLOYMENT
AEROSPACE INDUSTRY AND ALL MANUFACTURING INDUSTRIES

Calendar Years 1961-1980
(Thousands of Employees)

Year	All Manufacturing Industries TOTAL	Aerospace			Aerospace As Percent of All Manufacturing
		TOTAL	Production Workers	Other	
1961	16,326	1,178	612	566	7.2%
1962	16,853	1,270	635	635	7.5
1963	16,995	1,267	625	642	7.5
1964	17,274	1,209	600	609	7.0
1965	18,062	1,175	597	578	6.5
1966	19,214	1,375	731	644	7.2
1967	19,447	1,484	804	680	7.6
1968	19,781	1,502	807	695	7.6
1969	20,167	1,402	746	656	7.0
1970	19,349	1,166	604	562	6.0
1971	18,529	951	480	471	5.1
1972	19,151	912	455	457	4.8
1973	20,154	956	482	474	4.7
1974	20,077	982	494	488	4.9
1975	18,323	941	461	480	5.1
1976	18,997	896	433	463	4.7
1977	19,682	893	429	464	4.5
1978[r]	20,505	977	476	501	4.8
1979[r]	21,062	1,115	563	552	5.3
1980	20,361	1,190	600	590	5.8

Source: Manufacturing Employment from Bureau of Labor Statistics, "Employment and Earnings," (Monthly); Aerospace Employment from Aerospace Industries Association estimates, based on "Employment and Earnings," Bureau of Labor Statistics.

a "Other" employment includes salaried, clerical and maintenance employees, among others.

r Revised.

ANNUAL PAYROLL
AEROSPACE INDUSTRY AND ALL MANUFACTURING INDUSTRIES

Calendar Years 1961-1980
(Millions of Dollars)

Year	All Manufacturing Industries TOTAL	Aerospace[a]			Aerospace As Percent of All Manufacturing
		TOTAL	Production Workers	Other	
1961	$ 89,800	$ 9,140	$ 4,342	$ 4,798	10.2%
1962	96,700	10,232	4,871	5,361	10.6
1963	100,600	10,173	4,588	5,585	10.1
1964	107,100	10,067	4,563	5,504	9.4
1965	115,500	10,188	4,504	5,684	8.8
1966	128,000	12,139	5,641	6,498	9.5
1967	134,100	13,727	6,382	7,345	10.2
1968	145,800	14,397	6,582	7,815	9.9
1969	157,500	14,649	6,401	8,248	9.3
1970	158,200	12,275	5,322	6,953	7.8
1971	160,300	10,480	4,409	6,071	6.5
1972	175,400	10,504	4,280	6,224	6.0
1973	196,200	12,107	5,087	7,020	6.2
1974	211,400	13,535	5,672	7,863	6.4
1975	211,000	14,608	5,935	8,673	6.9
1976	237,400	14,881	5,951	8,930	6.3
1977	266,000	16,276	6,464	9,812	6.1
1978	299,200	19,501	7,873	11,628	6.5
1979	333,400	24,389	10,265	14,124	7.3
1980	350,700	28,741	12,076	16,665	8.2

Source: Manufacturing Payroll from Bureau of Economic Analysis, "Survey of Current Business;" Aerospace Payroll from Aerospace Industries Association estimates.

a Based on AIA estimates of annual average employment and earnings for the aerospace industry, derived from BLS data (see Glossary, "Aerospace Employment" and "Aerospace Payroll").

U.S. TURBINE-ENGINED AIRCRAFT IN THE WORLD AIRLINE FLEET

Calendar Years 1976–1980

	1976	1977	1978	1979	1980
TOTAL AIRCRAFT IN SERVICE	7,195	7,298	7,550	7,787	8,010
Number Manufactured in U.S.	4,891	5,027	5,159	5,341	5,590
Percent Manufactured in U.S.	68.0%	68.9%	68.3%	68.6%	69.8%
Turbojet Aircraft in Service	5,012	5,137	5,288	5,534	5,756
Number Manufactured in U.S.	4,237	4,345	4,467	4,671	4,916
Percent Manufactured in U.S.	84.5%	84.6%	84.5%	84.4%	85.4%
Turboprop Aircraft in Service	1,914	1,856	1,931	2,013	2,059
Number Manufactured in U.S.	455	429	422	477	515
Percent Manufactured in U.S.	23.8%	23.1%	21.9%	23.7%	25.0%
Turbine-Powered Helicopters in Service	269	305	331	240	195
Number Manufactured in U.S.	199	253	270	193	159
Percent Manufactured in U.S.	74.0%	83.0%	81.6%	80.4%	81.5%

Source: Exxon International Company, "Air World Survey," (Annually).
NOTE: The "Air World Survey" covers the world's airlines with the exception of Aeroflot, the USSR national airline, and includes aircraft in service on June 30. Excludes air taxi operators. Effective 1979, excludes a number of companies operating smaller types of aircraft and not providing scheduled services.

U.S. EXPORTS AND EXPORTS OF AEROSPACE PRODUCTS

Calendar Years 1960–1980
(Millions of Dollars)

Year	TOTAL Exports[a] of U.S. Merchandise	Exports of Aerospace Products[b]				
		TOTAL	Percent of Total U.S. Exports	Civil		Military
				Transports	Other	
1960	$ 20,375	$ 1,726	8.5%	$ 480	$ 609	$ 637
1961	20,754	1,653	8.0	263	615	775
1962	20,431	1,923	9.4	259	651	1,013
1963	23,062	1,627	7.1	191	541	895
1964	26,156	1,608	6.1	211	553	844
1965	27,127	1,618	6.0	353	501	764
1966	29,884	1,673	5.0	421	614	638
1967	31,142	2,248	7.2	611	769	868
1968	34,199	2,994	8.8	1,200	1,089	705
1969	37,462	3,138	8.4	947	1,080	1,111
1970	42,590	3,405	8.0	1,283	1,233	889
1971	43,492	4,203	9.7	1,567	1,513	1,123
1972	48,959	3,795	7.8	1,119	1,835	841
1973	70,246	5,142	7.3	1,664	2,124	1,354
1974	97,144	7,095	7.3	2,655	2,618	1,822
1975	106,561	7,792	7.3	2,397	2,927[r]	2,468[r]
1976	113,666	7,843	6.9	2,468	3,209[r]	2,166[r]
1977	119,006[r]	7,581	6.4	1,936	3,113	2,532
1978	141,126	10,001	7.1	2,558	3,460	3,983
1979	178,591[r]	11,747	6.6	4,998	4,774	1,975
1980	216,592	15,506	7.2	6,727	6,512	2,267

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly); "Highlights of U.S. Export and Import Trade," Report FT 990 (Monthly).

a Exports of domestic merchandise including DOD Military Assistance Program grant-aid shipments.

b Effective 1978, the "Schedule E" was revised, such that data for 1978 and subsequent years may not be strictly comparable to data for prior years.

r Revised.

GROSS NATIONAL PRODUCT, FEDERAL BUDGET AND DEFENSE BUDGET

Selected Fiscal Years
(Billions of Dollars)

Fiscal Year	GNP[r]	Federal Budget Outlays			DOD Outlays as Percent of	
		NET TOTAL[a]	DOD	Others	GNP[r]	Federal Budget[r]
1950—Lowest defense budget since World War II peak	$ 265.1	$ 43.1	$ 12.0	$ 32.8	4.5%	27.8%
1953—Korea peak	360.8	76.8	47.5	31.3	13.2	61.8
1964—Last prewar year	618.4	118.6	50.8	70.7	8.2	42.8
1968—South East Asia peak	834.4	178.8	78.0	105.3	9.3	43.6
1973—Actual	1,255.2	247.1	73.8	173.3	6.0	29.9
1974—Actual	1,381.5	269.6	78.4	191.2	5.7	29.1
1975—Actual	1,480.5	326.2	86.0	240.2	5.8	26.4
1976—Actual	1,642.7	366.4	88.5	277.9	5.4	24.2
1977—Actual	1,864.0	402.7	95.7	307.0	5.1	23.8
1978—Actual	2,085.3	450.8	103.0	347.8	4.9	22.8
1979—Actual	2,357.8	493.7	115.0	378.7	4.9	23.3
1980—Actual	2,567.6	579.6	136.1	443.5	5.3	23.5
1981—Estimate	2,844.3	655.2	161.9	493.3	5.7	24.7
1982—Estimate	3,191.8	695.3	188.0	507.3	5.9	27.0

Source: "The Budget of the United States Government" (Annually).
a "Net Total" is government-wide total less intragovernmental transactions.
r Revised.

FEDERAL OUTLAYS
SELECTED FUNCTIONS AND AEROSPACE PRODUCTS & SERVICES
Fiscal Years 1960–1981
(Millions of Dollars)

Year	TOTAL National Defense	TOTAL NASA	Federal Outlays for Aerospace Products & Services			Aerospace as Percent of Total National Defense and NASA
			TOTAL	DOD	NASA	
1960	$ 45,691	$ 401	$12,849	$12,502	$ 347	27.9%
1961	47,494	744	13,606	12,960	646	28.2
1962	51,103	1,257	15,135	13,992	1,143	28.9
1963	52,755	2,552	16,186	13,857	2,327	29.3
1964	53,591	4,171	17,938	14,205	3,733	31.1
1965	49,578	5,093	15,697	11,135	4,561	28.7
1966	56,785	5,933	17,771	12,411	5,360	28.3
1967	70,081	5,426	20,011	14,874	5,137	26.5
1968	80,517	4,724	21,355	16,757	4,598	25.1
1969	81,232	4,251	20,472	16,286	4,185	23.9
1970	80,295	3,753	18,747	15,048	3,699	22.3
1971	77,661	3,382	17,335	13,997	3,338	21.4
1972	78,336	3,422	16,999	13,627	3,372	20.8
1973	76,021	3,315	15,945	12,675	3,270	20.1
1974	78,569	3,256	15,782	12,601	3,181	19.3
1975	86,585	3,266	15,943	12,762	3,181	17.7
1976	89,996	3,669	16,843	13,295	3,548	18.0
Tr. Qtr.	22,518	952	3,944	3,018	926	16.8
1977	97,501	3,945	18,201	14,361	3,840	17.9
1978[r]	105,186	3,983	12,624	8,765[a]	3,859	11.6
1979	117,681	4,196	14,984	10,920	4,064	12.3
1980	135,856	4,852	18,297	13,585	4,712	13.0
1981[E]	162,115	5,274	21,392	16,274	5,118	12.8
1982[E]	188,826	5,895	25,448	19,707	5,741	13.1

Source: "The Budget of the United States Government" (Annually).

NOTE: "National Defense" includes the military budget of the Department of Defense and other defense-related activities. "Total NASA" includes research and development activities, administrative operations and construction of facilities. NASA construction is not included in "Total Aerospace Products and Services."

a Effective with FY 1978, DOD outlays for aircraft and missile procurement only; outlays for aircraft and missile RDT&E no longer available.

r Revised.

E Estimate.

FEDERAL OUTLAYS FOR AEROSPACE PRODUCTS & SERVICES

Fiscal Years 1960–1982
(Millions of Dollars)

Year	TOTAL	Department of Defense Procurement			NASA[a]
		TOTAL	Aircraft	Missiles	
1960	$ 9,646	$ 9,299	$ 6,272	$ 3,027	$ 347
1961	9,516	8,870	5,898	2,972	646
1962	11,244	10,101	6,659	3,442	1,143
1963	12,453	10,126	6,309	3,817	2,327
1964	13,363	9,630	6,053	3,577	3,733
1965	11,858	7,296	5,200	2,096	4,562
1966	14,064	8,704	6,635	2,069	5,360
1967	15,478	10,341	8,411	1,930	5,137
1968	16,279	11,681	9,462	2,219	4,598
1969	15,871	11,686	9,177	2,509	4,185
1970	14,559	10,860	7,948	2,912	3,699
1971	13,109	9,771	6,631	3,140	3,338
1972	14,365	10,993	5,927	5,066	3,372
1973	11,359	8,089	5,066	3,023	3,270
1974	11,168	7,987	5,006	2,981	3,181
1975	11,554	8,373	5,484	2,889	3,181
1976	12,364	8,816	6,520	2,296	3,548
Tr. Qtr.	2,885	1,959	1,557	402	926
1977	13,229	9,389	6,608	2,781	3,840
1978	12,624	8,765	6,971	1,794	3,859
1979	14,984	10,920	8,836	2,084	4,064
1980	18,297	13,585	11,124	2,461	4,712
1981[E]	21,392	16,274	13,115	3,159	5,118
1982[E]	25,448	19,707	15,630	4,077	5,741

Source: Department of Defense Budget (Annually); NASA Budget (Annually).
a Includes Research & Development, and Research & Program Management, excludes Construction of Facilities.
E Estimate.

DEPARTMENT OF DEFENSE AEROSPACE OUTLAYS

Fiscal Years 1960–1982
(Millions of Dollars)

Year	DOD Aerospace Outlays[a]		
	TOTAL	Procurement	Research, Development, Test and Evaluation
1960	$12,502	$ 9,299	$ 3,203
1961	12,960	8,870	4,090
1962	13,992	9,842	4,150
1963	13,857	10,126	3,731
1964	14,205	9,630	4,575
1965	11,135	7,296	3,839
1966	12,411	8,704	3,707
1967	14,875	10,341	4,534
1968	16,757	11,681	5,076
1969	16,286	11,686	4,600
1970	15,048	10,860	4,188
1971	13,997	9,771	4,226
1972	13,627	8,936	4,691
1973	12,675	8,089	4,586
1974	12,601	7,987	4,614
1975	12,762	8,373	4,389
1976	13,295	8,816	4,479
Tr. Qtr.	3,018	1,959	1,059
1977	14,361	9,389	4,972
1978	NA	8,765	NA
1979	NA	10,920	NA
1980	NA	13,585	NA
1981[E]	NA	16,274	NA
1982[E]	NA	19,707	NA

Source: Department of Defense Budget (Annually).
a Excludes Military Assistance.
E Estimate.
NA Not Available.

DEPARTMENT OF DEFENSE
TOTAL OUTLAYS BY FUNCTIONAL TITLE

Fiscal Years 1974–1982
(Millions of Dollars)

	1974	1975	1976
TOTAL	$77,626	$85,020	$88,036
PROCUREMENT—TOTAL	15,241	16,042	15,964
AIRCRAFT	5,006	5,484	6,520
MISSILES	2,981	2,889	2,296
Ships	2,104	2,627	2,606
Combat Vehicles, Weapons & Torpedoes	446	395	240
Ordnance, Vehicles & Related Equipment	2,044	1,492	856
Electronics & Communications	854	897	1,031
Other Procurement	1,806	2,258	2,415
RESEARCH, DEVELOPMENT, TEST & EVALUATION—TOTAL	8,582	8,866	8,923
AIRCRAFT	1,893	1,698	1,503
MISSILES	2,160	2,176	2,295
ASTRONAUTICS	561	515	581
Other	3,968	4,477	4,444
Military Personnel—TOTAL	28,856	31,210	32,359
Active Forces	22,150	23,235	23,259
Reserve Forces	1,579	1,733	1,804
Retired Pay	5,127	6,242	7,296
Military Construction	1,407	1,462	2,019
Family Housing	884	1,124	1,192
Civil Defense	75	86	80
Operations and Maintenance	22,478	26,330	27,902
Other	103	(100)	(403)

Source: Department of Defense Budget (Annually).
NOTE: Data in parentheses are credit items. The categories printed in capital letters are primarily aerospace, but others contain substantial parts attributable to aerospace activities.
E Estimate.
NA Not Available.

DEPARTMENT OF DEFENSE
TOTAL OUTLAYS BY FUNCTIONAL TITLE (Continued)

Fiscal Years 1974-1982
(Millions of Dollars)

Transition Quarter	1977	1978	1979	1980	1981[E]	1982[E]
$ 21,927	$ 95,650	$103,042	$115,013	$136,067	$161,923	$187,952
3,766	18,178	19,976	25,404	29,021	34,068	40,064
1,557	6,608	6,971	8,836	11,124	13,115	15,630
402	2,781	1,794	2,084	2,461	3,159	4,077
661	2,841	3,048	4,553	4,222	4,917	5,104
134	833	2,140	2,949	3,222	4,024	4,783
150	940	732	958	1,271	1,226	1,489
271	1,197	1,349	1,618	6,721	7,627	8,981
591	2,978	3,942	4,406			
2,206	9,795	10,508	11,152	13,127	15,160	19,156
410	2,176					
520	2,259	NA	NA	NA	NA	NA
129	537					
1,147	4,823					
8,305	33,931	36,246	38,686	42,761	50,325	54,475
5,846	23,857	25,116	26,300	28,465	33,803	35,337
512	1,858	1,959	2,107	2,376	3,152	3,417
1,947	8,216	9,171	10,279	11,920	13,870	15,721
376	1,914	1,932	2,080	2,450	2,530	2,679
296	1,358	1,405	1,468	1,680	1,872	2,002
18	93	82	—	3,227	3,323	3,152
7,261	30,587	33,578	36,424	44,770	53,757	61,335
(301)	(206)	(685)	(200)	(969)	388	5,089

AIRCRAFT PRODUCTION

In terms of dollar value, 1980 production of aircraft, engines, and parts reached an all-time high of $28.9 billion, up more than 17 percent over the 1979 previous record level of $24.6 billion.

As in the previous year, the increase was due primarily to a jump in non-government sales, which increased from $16 billion in 1979 to $19.4 billion in 1980, accounting for $3.4 billion of the total $4.3 billion aircraft sales gain. However, aircraft sales to government agencies—predominantly the Department of Defense—increased at a higher rate than in the previous year, climbing from $8.6 billion in 1979 to $9.5 billion in 1980.

The traditional industry sales pattern, in which aircraft production accounts for more than half of the industry's total sales, held true in 1980, with aircraft sales representing 54 percent of the total.

The backlog of orders for aircraft, engines, and related parts also increased appreciably, ending 1980 at $59.5 billion, compared to $50.5 billion at the end of 1979. Here again, the boost was primarily in non-government orders, which totaled $40.6 billion at year-end 1980. The

backlog for government orders of aircraft and related products increased $1.6 billion, from $17.3 billion in 1979 to $18.9 billion at year-end 1980.

Among other aircraft production highlights:

- General aviation experienced an unusual year in which shipments dropped by more than 5,000 units yet the dollar value of sales increased. Shipments totaled 11,881, the lowest level since 1972. Shipment value increased by some $300 million, to $2.5 billion. The higher value of fewer deliveries is explained by the fact that much of the production drop was in relatively low-value single-engine aircraft, the area most gretly impacted by the economic downturn of 1980. Increased sales of high-value jet and turboprop business aircraft more than offset lower single-engine sales.
- The steady growth of civil helicopter production in evidence since 1976 continued. The rotary wing segment of the industry produced 1,366 civil helicopters, 347 more than in the previous year. Dollar value increased from $403 million in 1979 to $656 million in 1980. There was also an upturn in production of military helicopters after several years of decline: the industry delivered 187 units, valued at $478 million, to the U.S. Government, plus 86 units, valued at $98 million, shipped commercially to foreign governments. The comparable figures for 1979 were 158 units, valued at $219 million, to the U.S. Government, plus 35 military units, valued at $54 million, exported commercially.
- Civil transport sales increased but not as dramatically as in the previous year. The industry delivered 387 jetliners valued at $9.9 billion. The comparable figures for 1979 were 376 transports worth $8 billion.

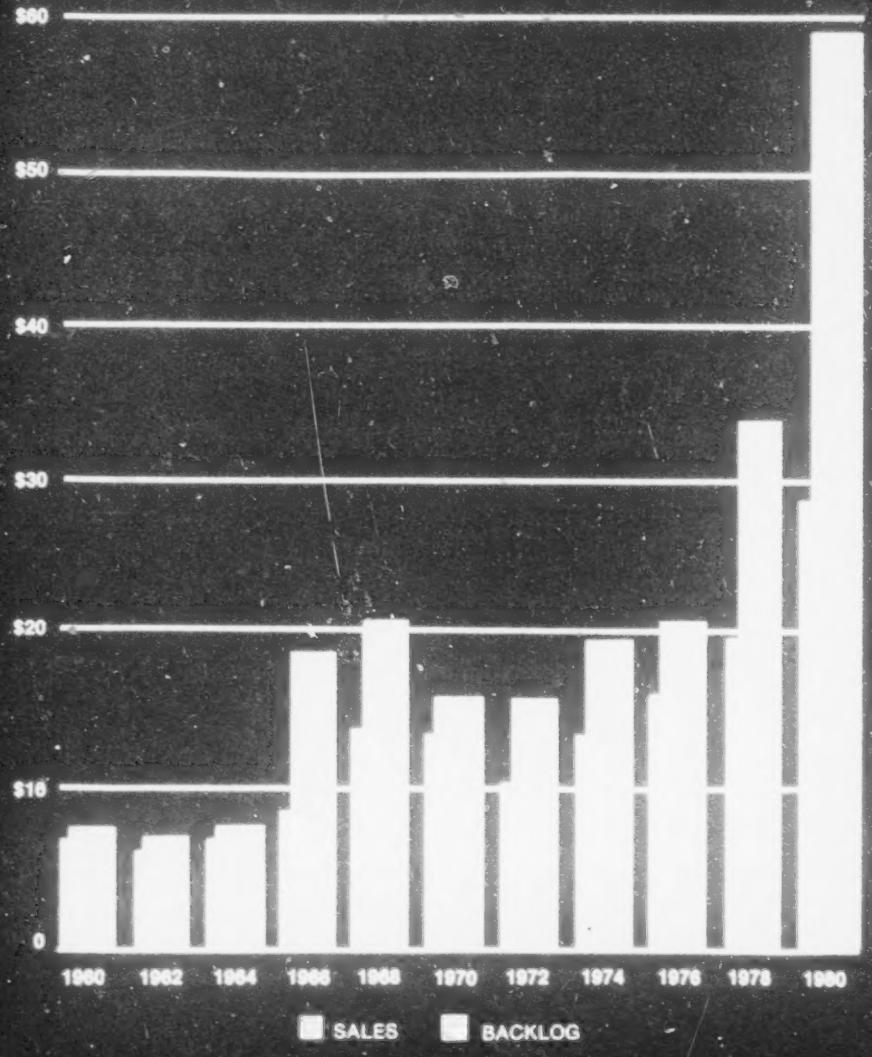
Transport backlog at year-end amounted to $20.8 billion in orders for 715 aircraft. This represents a decline from the previous year, when the industry had orders for 828 airplanes valued at $21.3 billion. However, the 1980 figure does not include orders placed late in the year for which contract negotiations had not been concluded by year-end.

Transport orders from foreign customers—401 airplanes worth $12.2 billion—accounted for more than half the total backlog, indicating continuance in immediate future years of the industry's high levels of export sales and contribution to the U.S. trade balance.

Military aircraft production increased in number of deliveries and in dollar value. The Department of Defense accepted 606 aircraft for operation by the U.S. military services, and also accepted 194 aircraft for delivery to foreign governments under Foreign Military Sales and Military Assistance Programs. The total value of DoD acceptances for U.S. military agencies and for FMS/MAP shipments, was $5.8 billion (up $300 million). The industry also produced 228 military-type aircraft exported commercially on a direct manufacturer-to-foreign government basis.

COMPLETE AIRCRAFT, ENGINES, AND PARTS SALES AND BACKLOG

(Billions of Dollars)



Source: Survey of the Census

AIRCRAFT SALES AND BACKLOG
COMPLETE AIRCRAFT, AIRCRAFT ENGINES, AND PARTS

Calendar Years 1966–1980
(Millions of Dollars)

Year	TOTAL			Aircraft & Parts		Aircraft Engines & Parts	
	TOTAL	U.S. Gov't.	Other	U.S. Gov't.	Other	U.S. Gov't.	Other
SALES							
1966	$ 8,725	$ 5,456	$ 3,267	$ 4,084	$ 2,744	$ 1,372	$ 523
1967	11,844	7,141	4,703	6,445	3,797	1,716	1,016
1968	13,850	7,411	6,439	6,047	5,166	1,713	1,251
1969	12,764	7,161	5,603	5,362	4,517	1,774	1,086
1970	13,466	7,588	5,878	5,674	4,683	1,912	1,197
1971	11,392	6,315	5,077	3,953	4,043	1,968	996
1972	10,153	4,954	5,199	1,966	4,065	1,268	1,114
1973	12,276	5,539	6,737	3,231	5,322	1,308	1,417
1974	13,542	5,482	8,060	3,542	6,436	1,420	1,714
1975	14,656	6,859	7,797	5,269	6,067	1,590	1,746
1976	15,938	8,114	7,824	6,338	6,800	1,776	1,722
1977	16,375	8,845	7,530	6,855	6,477	1,990	1,660
1978	19,305	8,724	10,581	6,654	7,873	1,971	2,708
1979	24,672	8,649	16,023	6,178	12,707	2,271	3,322
1980	28,926	9,446	19,480	6,742	15,284	2,754	4,196
BACKLOG—AS OF DECEMBER 31							
1966	$18,479	$ 8,761	$ 9,718	$ 6,515	$ 8,140	$ 2,246	$ 1,578
1967	19,084	10,699	8,385	8,753	8,667	4,059	
1968	20,559	8,150	12,409	5,464	10,684	2,151	1,908
1969	19,188	7,089	12,099	5,270	10,340	1,814	1,759
1970	15,213	5,413	9,800	4,582	8,601	1,250	1,149
1971	14,260	6,223	8,037	4,478	7,123	1,745	914
1972	15,632	7,027	8,605	5,709	7,455	1,322	1,150
1973	16,365	7,815	8,550	6,712	7,202	1,103	1,348
1974	19,441	9,799	9,642	7,908	7,741	2,047	1,793
1975	18,892	10,751	8,141	8,743	6,446	2,008	1,695
1976	20,679	11,950	8,729	9,439	7,316	2,511	1,513
1977	25,063	12,471	12,592	9,597	10,152	2,874	2,440
1978	33,804	14,847	18,972	11,794	16,508	3,053	2,464
1979	50,484	17,319	33,166	13,331	27,965	3,988	5,213
1980	59,532	18,927	40,605	14,134	33,743	4,793	6,862

U.S. AIRCRAFT PRODUCTION[a]

(Number of Aircraft)
Calendar Years 1976–1980

	1976	1977	1978	1979	1980
TOTAL	17,747	19,047	19,958	19,287	14,662
Civil Aircraft—TOTAL[b]	16,429	17,913	18,962	18,450	13,634
Domestic Shipments[c]	12,738	14,022	15,012	13,913	9,694
Transports	64	54	130	176	150
Helicopters	442	527	536	560	841
General Aviation	12,232	13,441	14,346	13,177	8,703
Exports	3,691	3 891	3,950	4,537	3,940
Transports	158	101	111	200	237
Helicopters	315	321	368	459	525
General Aviation	3,218	3,469	3,471	3,878	3,178
Military Aircraft—TOTAL	1,318	1,134	996	837	1,028
Acceptances by U.S. Military Agencies	1,143	862	723	734	800
For Use by U.S. Military Agencies	625	454	467	531	606
For Shipment to Foreign Governments Under Foreign Military Sales and Military Assistance Programs	518	408	256	203	194
Commercial Exports[d]	175	272	273	103	228

Source: Civil Shipments: Aerospace Industries Association and General Aviation Manufacturers Association, company reports.
Civil Exports: Department of Commerce, Report FT410.
Acceptances by U.S. Military Agencies: Department of Defense.
Commercial Military Exports: AIA estimate based on Department of Commerce data.

a U.S. aircraft production data have been revised for 1976-1979 to include military aircraft exported commercially (manufacturer-to-government). Data for prior years will be revised and included in future editions of AEROSPACE FACTS AND FIGURES.

b Civil aircraft shipments data have been revised for 1976-1979 to exclude the Lockheed C-130 military transport.

c Calculated as the difference between total shipments, per company reports to AIA, and exports, per Department of Commerce data.

d Calculated as the difference between total military aircraft exports (excluding used and rebuilt aircraft, and airships, balloons, and gliders), as reported by the Department of Commerce, and shipments under Foreign Military Sales and Military Assistance Programs, as reported by the Department of Defense.

CIVIL AIRCRAFT SHIPMENTS

Number and Value
Calendar Years 1966–1980

Year	TOTAL	Transport Aircraft	Helicopters	General Aviation
NUMBER OF AIRCRAFT SHIPPED				
1966	16,674	344	583	15,747
1967	14,512	480	455	13,577
1968	14,922	702	522	13,698
1969	13,505	514	534	12,457
1970	8,076	311	482	7,283
1971	8,158	223	469	7,466
1972	10,576	227	575	9,774
1973	14,709	294	770	13,645
1974	15,326	332	828	14,166
1975	15,251	315	864	14,072
1976[a]	16,429	222	757	15,450
1977[a]	17,913	155	848	16,910
1978[a]	18,962	241	904	17,817
1979[a]	18,450	376	1,019	17,055
1980	13,634	387	1,366	11,881
VALUE—Millions of Dollars				
1966	$ 2,183	$1,699	$ 40	$ 444
1967	2,861	2,458	43	360
1968	4,267	3,789	57	421
1969	3,598	2,939	75	584
1970	3,546	3,158	49	339
1971	2,984	2,594	69	321
1972	3,308	2,660	90	558
1973	4,665	3,718	121	826
1974	5,091	3,993	189	909
1975	5,086	3,779	274	1,033
1976[a]	4,592	3,078	285	1,229
1977[a]	4,451	2,649	251	1,551
1978[a]	6,458	4,308	328	1,822
1979[a]	10,644	8,030	403	2,211
1980	13,058	9,895	656	2,507

Source: Transport Aircraft and Helicopters: Aerospace Industries Association, company reports.
General Aviation: General Aviation Manufacturers' Association and Aerospace Industries Association, company reports.

a Transport aircraft shipments data have been revised for 1976-1979 to exclude the Lockheed C-130, such that data for previous years are not strictly comparable.

CIVIL TRANSPORT AIRCRAFT BACKLOG[a]

As of December 31, 1976–1980

Company and Model	1976	1977	1978	1979	1980
TOTAL AIRCRAFT ON ORDER					
(Domestic and Foreign Orders)	242	345	622	828	715
VALUE (Millions of Dollars)	$ 3,568	$ 6,182	$13,098	$21,322	$20,799
Boeing—TOTAL	155	242	426	611	535
B-707	5	4	1	—	—
B-727	106	157	195	212	104
B-737	22	36	111	159	175
B-747	22	45	89	106	71
B-757	—	—	—	40	49
B-767	—	—	30	94	136
Lockheed—TOTAL	25	18	40	56	50
L-1011	24	18	40	56	47
L-100	1	—	—	—	3
McDonnell Douglas—TOTAL	62	85	156	161	130
DC-9	47	55	101	108	105
DC-10	15	30	55	53	25
TOTAL FOREIGN ORDERS	109	165	304	436	401
VALUE (Millions of Dollars)	$ 2,096	$ 3,785	$ 7,100	$11,848	$12,166
Boeing—TOTAL	50	95	194	312	303
B-707	5	4	1	—	—
B-727	13	35	51	74	48
B-737	12	16	77	127	134
B-747	20	40	65	88	70
B-757	—	—	—	19	22
B-767	—	—	—	4	29
Lockheed—TOTAL	17	11	17	33	32
L-1011	16	11	17	33	29
L-100	1	—	—	—	3
McDonnell Douglas—TOTAL	42	59	93	91	66
DC-9	30	41	58	58	46
DC-10	12	18	35	33	20

Source: Aerospace Industries Association, company reports.

a This table has been revised to report only firm unfilled orders; number and value of options have been deducted from data previously reported for 1976–1979.

CIVIL TRANSPORT AIRCRAFT SHIPMENTS AND EXPORTS 1976-1980

CIVIL TRANSPORT AIRCRAFT SHIPMENTS

Calendar Years 1976-1980

Company and Model	1976	1977	1978	1979	1980
TOTAL					
Number of Aircraft Shipped	222	155	241	376	387
Value (Millions of Dollars)	$3,078	$2,649	$4,308	$8,030	$9,895
Boeing—TOTAL	132	115	193	281	296
B-707	3	3	3	1	—
B-727	61	67	116	136	131
B-737	41	25	40	77	92
B-747	27	20	32	67	73
Lockheed—TOTAL	27	12	10	21	26
L-1011	16	11	8	14	24
L-100	11	1	2	7	2
McDonnell Douglas—TOTAL	63	28	38	74	65
DC-9	44	16	20	39	25
DC-10	19	12	18	35	40

COMMERCIAL HELICOPTER SHIPMENTS[a]

Calendar Years 1976–1980

Company and Model	1976	1977	1978	1979	1980
COMMERCIAL SHIPMENTS	775	884	935	1,054r	1,452
Value (Millions of Dollars)	$ 305	$ 316	$ 367	$ 457r	$ 754
CIVIL SHIPMENTS	757	848	904	1,019	1,366
Value (Millions of Dollars)	$ 285	$ 251	$ 328	$ 403	$ 656
Bell—TOTAL	424	374	438	612r	780
47 series	11	—	—	—	—
204 series	2	—	—	—	—
205 series	36	11	23	18	30[c]
206 series	290[c]	283	322	469	550
212 series	71	47	50	86	116
214 series	13	9	16	8	7
222	—	—	—	—	41
AH-1J[b]	1	7	—	—	—
AH-1S[b]	—	—	—	1r	1
UH-1H[b]	—	17	27	30r	35
Boeing-Vertol—TOTAL	11	12	4	4	6
CH-47[b]	11	12	4	4	6
Brantly-Hynes—TOTAL	2	1	11	2	—
B-2B	2	1	11	2	—
Enstrom—TOTAL	87	96	91	46	48
F-28 series	44	44	44	27	18
280 series	43	52	47	19	30
Hiller—TOTAL	34	40	52	43	49
12-E series	31	35	52	43	41
12-ET series	3	5	—	—	8[c]
Hughes--TOTAL	204	336	312	306	401
300 series	94	125	116	110	136
500 series	110	211	196	196	265[c]
Robinson—TOTAL	—	—	—	—	78
R22	—	—	—	—	78
Sikorsky (UTC)—TOTAL	13	25	27	41	90
S-61	13	25	27	5	5
S-76	—	—	—	36	85

Source: Aerospace Industries Association, company reports.

NOTE: All data exclude production by foreign licensees.

a Shipments to customers other than the U.S. Government, including all civil shipments plus commercial (manufacturer-to-customer) military exports, and excluding deliveries to U.S. military agencies for shipment to foreign governments under Military Assistance Programs and Foreign Military Sales.

b Military configuration for commercial export sale.

c Includes the following helicopters exported in military configuration: 6 Bell 206's in 1976, 4 Bell 205's, 4 Hiller 12-ET's, and 36 Hughes 500's in 1980.

r Revised.

GENERAL AVIATION AIRCRAFT SHIPMENTS

By Selected Manufacturers
Calendar Years 1976–1980

	1976	1977	1978	1979	1980
NUMBER OF AIRCRAFT SHIPPED	15,450	16,910	17,817	17,055	11,881
Single-Engine, Piston	11,803	13,167	13,651	12,693	8,283
Multi-Engine, Piston	2,120	2,195	2,630	2,843	2,116
Agricultural	980	890	748	593	357
Turboprop	359	428	548	637	795
Turbojet	188	230	240	289	330
VALUE OF SHIPMENTS[a] (Millions of Dollars)	$1,229	$1,551	$1,822	$2,211	$2,507
Single-Engine, Piston	364	435	486	490	365
Multi-Engine, Piston	343	389	492	557	402
Agricultural	37	39	33	35	25
Turboprop	223	295	393	550	874
Turbojet	262	393	418	579	841
Number of Aircraft By Selected Manufacturer					
Ayres	—	—	134	99	44
Beech	1,220	1,203	1,367	1,508	1,394
Bellanca	315	252	370	443	103
Cessna	7,888	8,839	8,770	8,400	6,393
Gates Learjet	84	105	102	107	120
Gulfstream American	762	866	933	400	167
Lake	88	99	98	96	79
Lockheed Jetstar	3	16	9	7	4
Maule	96	108	88	67	59
Mooney	227	362	379	439	332
Piper	4,042	4,499	5,272	5,255	2,954
Rockwell International	595	432	244	164	146
Swearingen	30	28	51	70	86
Ted Smith Aerostar	100	101	—	—	—

Source: Aerospace Industries Association and General Aviation Manufacturers' Association
a Manufacturers' net billing price

MILITARY AIRCRAFT ACCEPTED BY U.S. MILITARY AGENCIES

Number and Flyaway Value
Calendar Years 1966–1980

Year	TOTAL	Bomber/ Patrol	Fighter/ Attack	Trans- port	Trainer	Heli- copter	Other
NUMBER							
1966	3,609	214	627	142	442	2,164	20
1967	4,481	404	811	135	331	2,448	352
1968	4,440	34	1,007	18	292	2,800	289
1969	3,644	31	792	44	295	2,165	317
1970	3,085	66	734	37	173	1,944	131
1971	2,232	48	386	42	135	1,587	34
1972	2,117	13	563	29	148	1,312	52
1973	1,372	30	422	22	90	808	—
1974	1,110	50	478	27	49	506	—
1975	1,369	62	624	34	40	601	8
1976	1,143	55	646	67	11	348	16
1977	862	44	488	25	12	273	20
1978	723	22	478	36	—	166	21
1979	734	12	529	21	—	158	14
1980	800	12	559	16	18	187	8
FLYAWAY VALUE—Millions of Dollars							
1966	$3,554	$ 612	$1,289	$ 701	$ 190	$ 749	$ 13
1967	4,476	822	1,721	759	144	962	68
1968	3,871	117	2,451	81	167	905	150
1969	3,693	248	2,204	101	164	845	131
1970	3,920	545	1,940	555	111	694	75
1971	2,996	397	1,322	688	112	469	8
1972	3,247	129	2,068	536	100	396	18
1973	2,571	325	1,490	348	140	268	—
1974	2,224	584	1,222	101	111	206	—
1975	3,172	599	2,054	128	27	359	5
1976	4,729	547	3,421	340	27	384	10
1977	4,364	499	3,190	331	14	316	14
1978	4,664	313	3,496	613	—	225	17
1979	5,470	199	4,660	379	—	219	13
1980	5,846	206	4,801	322	32	478	7

Source: Department of Defense.

NOTE: Data exclude gliders and targets, and include spares, spare parts, and support equipment that are procured with the aircraft. 1966–1967, Navy attack planes included with bombers; 1968–1978, Navy attack planes included under fighter/attack. Effective 1972, includes aircraft accepted for shipment to foreign governments for military assistance programs and foreign military sales. 1972–1975, Flyaway value does not include the value of planes produced for the security assistance programs and accepted by the USAF.

r Revised.

MILITARY AIRCRAFT PRODUCTION FOR UNITED STATES AIR FORCE[a] BY TYPE AND MODEL

Calendar Years 1979 and 1980
(Millions of Dollars)

Type and Model	Number		Flyaway Cost[b]		Weapon System Cost[c]	
	1979	1980	1979[r]	1980	1979[r]	1980
AIR FORCE—TOTAL	311	359	$2,807	$2,848	$3,318	$3,495
Fighter/Attack—TOTAL	298	347	2,500	2,566	2,892	3,119
A-10A	129	144	593	697	680	781
F-15A/B/C/D	109	84	1,359	1,024	1,414	1,180
F-16A/B	60	119	548	845	798	1,158
Transports/Tankers—TOTAL	8	8	64	82	65	84
C-130H	8	8	64	82	65	84
Command/Control—TOTAL	5	4	243	200	361	292
E-3A	5	4	243	200	361	292

Source: Department of the Air Force.
NOTE: Costs shown are approximate. Calendar year acceptances may derive from procurement quantities funded in more than one fiscal year.

a. Air Force acceptances for own use; exclude FMS/MAP shipments.
b. Flyaway Cost includes airframe, engines, electronics, communications, armament, other installed equipment and non-recurring costs associated with the manufacture of the aircraft.
c. Weapon System Cost includes flyaway costs, peculiar ground equipment, training equipment and technical data.
r. Revised.

MILITARY AIRCRAFT PRODUCTION FOR UNITED STATES NAVY[a] BY TYPE AND MODEL

Calendar Years 1979 and 1980
(Millions of Dollars)

Type and Model	Number		Flyaway Cost[b]		Weapon System Cost[c]	
	1979	1980	1979[r]	1980	1979[r]	1980
NAVY—TOTAL	103	87	$1,244	$1,181	$1,634	$1,591
Patrol—TOTAL	12	12	199	206	326	347
P-3C	12	12	199	206	326	347
Attack—TOTAL	35	33	299	332	385	451
A-4M	5	—	16	—	19	—
A-6E	12	12	94	102	114	146
EA-6B	6	6	107	127	126	170
A-7E	12	15	82	103	126	135
Fighters—TOTAL	38	42	707	643	866	793
F-14A	38	42	707	643	866	793
Helicopters—TOTAL	18	—	39	—	57	—
AH-1T	15	—	35	—	52	—
UH-1N	3	—	4	—	5	—

Source: Department of the Navy.
a Navy acceptances for own use; exclude FMS/MAP shipments.
b Flyaway Cost includes airframe, engines, electronics, communications, armament and other installed equipment.
c Weapon System Cost includes flyaway items, initial spares, ground equipment, training equipment and other support items.
r Revised.

MILITARY AIRCRAFT PRODUCTION FOR UNITED STATES ARMY[a] BY TYPE AND MODEL

Calendar Years 1979 and 1980
(Millions of Dollars)

Type and Model	Number		Flyaway Cost[b]	
	1979	1980	1979	1980
ARMY—TOTAL	117	160	$167	$463
Helicopters—TOTAL	103	152	154	456
AH-1S	73	78	86	137
CH-47C	—	7	—	74
UH-60A	30	67	68	245
Other—TOTAL	14	8	13	7
C-12C	14	—	13	—
C-12D	—	6	—	5
UV-18	—	2	—	2

Source: Department of the Army.
a Army acceptances for own use; exclude FMS/MAP shipments.
b Flyaway cost includes airframes, engines, electronics, communications, armament and other installed equipment.
r Revised.

MILITARY AIRCRAFT PRODUCTION FOR MILITARY ASSISTANCE PROGRAMS AND FOREIGN MILITARY SALES, BY ACCEPTING AGENCY, TYPE AND MODEL

Calendar Years 1979 and 1980
(Millions of Dollars)

Accepting Agency, Type and Model	Number of Aircraft Accepted		Flyaway Cost[a]	
	1979	1980	1979	1980
TOTAL ACCEPTANCES FOR REIMBURSABLE PROGRAMS	203	194	$1,252	$1,354
Air Force—TOTAL	166	154	1,226	1,301
Fighter/Attack—TOTAL	158	137	1,154	1,260
A-37	—	10	—	1
F-4E/F	22	—	224	—
RF-4E	5	—	63	—
F-5E	68	47	255	202
F-5F	33	17	153	90
F-15C/D	—	2	—	34
F-16	30	61	459	933
Transport/Tankers—TOTAL	8	4	72	40
C-130H	8	4	72	40
Trainers—TOTAL	—	13	—	0.6
T-33	—	4	—	0.2
T-37	—	9	—	0.4
Navy—TOTAL	—	5	—	31
Trainers—TOTAL	—	5	—	31
TA-7H	—	5	—	31[b]
Army—TOTAL	37	35	26	22
Helicopters—TOTAL	37	35	26	22
AH-1S	6	—	7	—
UH-1H	31	35	19	22

Source: Departments of the Air Force, Navy and Army.

a Flyaway cost includes airframe, engines, electronics, communications, armament, other installed equipment and nonrecurring costs associated with the manufacture of the aircraft.

b Engines excluded.

DEPARTMENT OF DEFENSE
OUTLAYS FOR AIRCRAFT PROCUREMENT

By Agency
Fiscal Years 1960–1982
(Millions of Dollars)

Year	TOTAL AIRCRAFT PROCUREMENT	Air Force	Navy	Army
1960	$ 6,272	$ 4,414	$ 1,765	$ 93
1961	5,898	3,926	1,832	140
1962	6,659	4,387	2,102	170
1963	6,309	3,747	2,328	234
1964	6,053	3,894	1,859	300
1965	5,200	3,115	1,739	346
1966	6,635	4,074	2,021	540
1967	8,411	4,842	2,607	962
1968	9,462	5,079	3,244	1,139
1969	9,177	5,230	2,821	1,126
1970	7,948	4,623	2,488	837
1971	6,631	3,960	2,125	546
1972	5,927	3,191	2,347	389
1973	5,066	2,396	2,557	113
1974	5,006	2,078	2,806	122
1975	5,484	2,211	3,137	136
1976	6,520	3,323	3,061	136
Tr. Qtr.	1,557	859	672	26
1977	6,608	3,586	2,721	301
1978	6,971	3,989	2,602	380
1979	8,836	5,138	3,140	558
1980	11,124	6,647	3,689	788
1981[E]	13,115	7,893	4,288	934
1982[E]	15,630	8,867	5,684	1,079

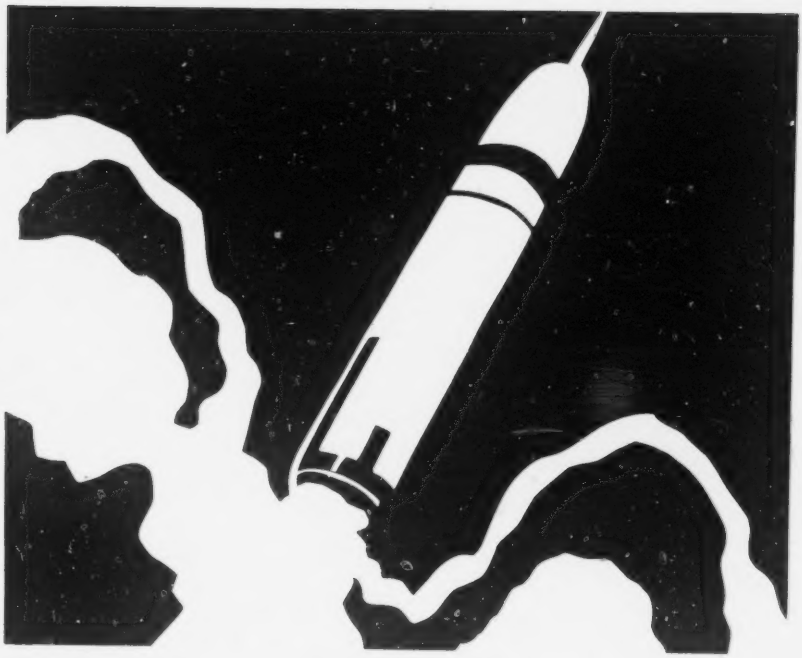
Source: Department of Defense Budget (Annually).
E Estimate.

MILITARY AIRCRAFT PROGRAM PROCUREMENT INCLUDING INITIAL SPARES[a]

Fiscal Years 1980, 1981 and 1982
(Millions of Dollars)

Agency, Type and Model	1980		1981[E]		1982[E]	
	No.	Cost	No.	Cost	No.	Cost
AIR FORCE						
A-7K	12	$ 131.1	6	$ 118.7	—	$ —
A-10 A/E	144	912.6	60	641.5	—	561.3
B-52G Cruise Missile Carrier Aircraft Modification	22	81.7	40	116.5	40	118.9
B-52G/H Avionics Modernization	31	338.9	64	288.7	61	208.2
C-5 Wing Modification	4	87.7	12	167.5	18	193.3
Civil Reserve Air Fleet (CRAF)	2	38.6	2	39.8	3	50.8
C-130 Hercules	7	74.4	6	72.5	—	—
C-141 Modification	124	76.0	33	25.6	—	—
E-3A (AWACS)	3	327.2	2	272.0	2	275.0
EF-111A Modification	3	105.5	12	272.4	12	264.3
F-15 Eagle	60	1,059.7	42	1,039.8	42	1,330.1
F-16 Multimission Fighter	175	1,659.9	180	1,953.3	120	2,069.6
KC-10A (ATCA)	4	194.8	6	327.0	8	480.0
KC-135 Re-engining	—	5.0	1	104.5	—	216.3
TR-1	2	44.2	4	125.3	6	142.4
NATO AWACS Program	—	243.1	—	382.0	—	358.2
NAVY						
A-6E Intruder	6	$ 157.5	12	$ 270.7	12	$ 295.2
A-7E Corsair II	—	14.5	—	31.2	—	—
AV-8B	—	—	—	90.0	—	—
C-9B Skytrain II	—	—	2	40.4	—	—
CH-53E Super Stallion	15	209.8	14	207.7	11	253.9
E-2C Hawkeye	6	201.6	6	237.0	6	265.8
EA-6B Prowler	6	182.0	6	225.0	6	272.1
EC-130Q Hercules	3	92.8	1	46.0	2	76.9
F-14A Tomcat	30	766.3	30	930.9	30	1,163.8
F/A-18 Hornet	25	1,119.7	60	2,012.0	63	2,476.5
H-46 Modification	—	129.8	—	104.9	—	63.2
P-3C Orion	12	309.6	12	308.5	12	475.0
P-3 Modifications	—	70.0	—	116.3	—	110.8
SH-60B Seahawk LAMPS	—	—	—	105.0	18	772.1
SH-2F Seasprite (LAMPS MK-I)	—	—	—	19.7	18	238.0
T-34C Mentor	—	1.1	60	41.6	60	53.2
T-44A Trainer	—	0.9	—	—	—	—
TH-57A Sky Ranger	—	—	32	13.5	30	15.8
UC-12B	22	25.9	—	0.4	—	0.2
ARMY						
AH-1S Cobra/Tow	15	$ 30.0	17	$ 57.7	—	$ —
AH-64 Attack Helicopter	—	—	—	58.8	14	473.5
C-12D	10	12.2	6	9.0	—	—
UH-60A Black Hawk	94	380.7	80	506.1	96	641.7
CH-47 Modernization	—	28.8	—	153.2	—	228.0

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget, (Annually).
a Total Obligational Authority.
E Estimate.



MISSILE PROGRAMS

In 1980, industry sales of missile systems dropped below the previous year's level but backlog increased sharply. Sales amounted to $4.5 billion, compared with $4.7 billion in 1979. The figures include sales of missiles systems, parts and propulsion units, but do not include funding for research, development, test and evaluation. Backlog at the end of 1980 topped $7 billion, up more than $1 billion from year-end 1979.

On the basis of estimated procurement authority for Fiscal Year 1981, the largest production program was the Navy's Trident 1 fleet ballistic missile, operational since late 1979. Production of Air Force cruise missiles ranked as the second largest program. During 1980, the USAF selected the AGM-87B weapon as its Air Launched Cruise Missile and ordered start of production. Tentative plans called for eventual production of some 3,000 ALCMs, the first to become operational in 1983. Also in production and scheduled for initial operational capability in 1983 was the BGM-109 Tomahawk Ground Launched Cruise Missile. In limited production and development status was the Navy's sea-launched version

of the Tomahawk.

Principal Army missiles in production status were the Patriot air defense missile system and the US Roland short-range anti-aircraft weapon. Ordered into initial production during the year were the Army's self-propelled Multiple Launch Rocket System (MLRS), designed to neutralize enemy field artillery and air defense systems; the Navy's High-speed Anti-Radiation Missile (HARM), an air-to-surface weapon; and the Sparrow 3 AIM-7M, latest member of the air-to-air missile family used by both the USAF and the Navy.

Other major missile systems in production during 1980/81 included the Navy's Harpoon, an anti-shipping weapon launched from aircraft or surface vessels; four versions of the Standard, the Navy's fleet air defense missile; Phoenix, a Navy long range air-to-air missile; several versions of the infrared-guided Sidewinder and the radar-guided Sparrow, USAF/Navy air-to-air missiles; the Improved Hawk mobile air defense system, operational with Army, Marine Corps and NATO units; the Army Dragon, a wire-guided antitank weapon; the Army's man-portable, shoulder-fired Stinger short range antiaircraft missile; the TOW antitank missile, being procured for the Army and the Marine Corps; and the Copperhead laser-guided, cannon-launched projectile, an Army artillery weapon fired from conventional howitzers.

Scheduled for progression from development to production status under Fiscal Year 1982 funding are the Air Force's Imaging Infrared Maverick air-to-surface missile; the Army's Laser Hellfire, a long range helicopter-launched antiarmor weapon; and the Army's Pershing 2, a nuclear missile with greater range than the operational Pershing 1A.

Heading the list of major missiles in research and development status is the Air Force M-X mobile ICBM, intended for operational service in the late 1980s. Also in development is the Navy Trident 2 submarine launched ballistic missile, an advancement of the operational Trident 1 with greater range, heavier payload and improved accuracy. A new cruise missile program in engineering development status is the Air Force/Navy Medium Range Air-to-Surface Missile (MRASM), a variant of the Tomahawk designed for use with tactical aircraft. Intended as a replacement for the Sparrow missile in wide service use is the Advanced Medium Range Air-to-Air Missile (AMRAAM), being developed for USAF/Navy use.

A major missile-related R&D activity under Air Force cognizance is the Advanced Ballistic Re-Entry Systems (ABRES) program, designed to provide for advanced development of re-entry vehicles for use on existing or future ICBMs and sea-launched ballistic missiles; research focuses on such areas as missile nosetip erosion studies, materials development, manuevering re-entry vehicles, decoys and other penetration aids.

MISSILE PROGRAM PROCUREMENT INCLUDING INITIAL SPARES[a]

Fiscal Years 1980, 1981 and 1982
(Millions of Dollars)

Agency, Type and Model	1980		1981[E]		1982[E]	
	No.	Cost	No.	Cost	No.	Cost
AIR FORCE						
ALCM	225	$372.3	480	$579.6	440	$605.4
GLCM	—	8.2	11	166.5	54	363.0
IR Maverick	—	—	—	—	490	204.2
Minuteman II/III	—	109.2	—	142.7	—	152.1
Rapier	—	—	—	90.0	—	142.0
Target Drones[b]	—	54.4	—	50.4	—	99.4
NAVY						
Harm	—	$ —	80	$103.8	—	$ —
Harpoon	240	151.1	240	220.1	340	303.4
Laser Maverick	—	—	—	—	—	5.1
Phoenix	60	108.3	210	161.3	72	169.1
Poseidon	—	23.8	—	26.2	—	18.7
Sidewinder[c]	2,370	108.4	1,500	151.3	2,710	191.8
Sparrow[c]	1,560	188.5	1,975	334.1	2,575	391.1
Standard ER (SM-2)	55	50.8	275	144.8	375	222.3
Standard MR (SM-1)	480	107.3	500	122.4	600	168.1
Standard MR (SM-2)	30	24.4	70	39.5	120	58.5
Tomahawk	6	30.2	50	191.2	88	236.6
Trident I	82	765.5	72	829.7	72	906.9
ARMY						
Chaparral	—	$ 3.2	—	$ 44.4	—	$ 4.4
Copperhead	2,100	71.2	4,300	122.1	4,229	115.7
Dragon	—	—	—	8.6	—	—
Improved Hawk[d]	197	32.5	—	30.3	440	96.7
Laser Hellfire	—	—	—	20.7	1,075	131.8
MLRS	1,374	63.6	2,340	116.5	2,496	204.8
Patriot	155	413.8	130	462.2	364	900.5
Pershing II	—	—	—	4.0	39	219.7
Roland	410	299.7	400	428.9	795	529.3
Stinger[d]	2,054	91.6	1,703	101.1	3,173	263.5
TOW[d]	6,260	28.7	12,000	95.6	14,666	142.3

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually).
E Estimate.
a Total Obligational Authority.
b Includes Army, Navy and Air Force procurement.
c Includes Navy and Air Force procurement.
d Includes Army and Marine Corps procurement.

MAJOR MISSILES
RESEARCH, DEVELOPMENT, PRODUCTION, OPERATION

Project	Agency	Status	Systems Contractor	Propulsion Manufacturer	Guidance Manufacturer
AIR-TO-AIR					
AMRAAM	USAF/USN	D	Hughes/ Raytheon	—	Hughes/ Raytheon
ASALM	USAF	R,D	Martin Marietta/ McDonnell Douglas	—	—
Falcon	USAF	O	Hughes	Thiokol	Hughes
Phoenix-54A	USN	O	Hughes	Hercules	Hughes
Phoenix-54C	USN	D	Hughes	Hercules	Hughes
Sidewinder-9G	USN	O	NASC	Bermite/ Hercules	Raytheon
Sidewinder-9H	USN	O	Ford/ Raytheon	Bermite/ Hercules	Ford Aerospace
Sidewinder-9J	USAF	O	Ford Aerospace	Hercules/ Aerojet	Ford Aerospace
Sidewinder-9L	USN/USAF	P,O	NASC/Raytheon/Ford	Bermite	Raytheon/ Ford Aero.
Sidewinder-9M	USN/USAF	P	NASC/ Raytheon	Thiokol	Raytheon
Sidewinder-9N	USAF	O	Ford Aero.	—	Ford Aero.
Sidewinder-9P	USAF	P,O	Ford Aero.	—	Ford Aero.
Sparrow-7E	USN/USAF	P,O	Raytheon	Hercules/ Aerojet	Raytheon
Sparrow-7F	USN/USAF	P,O	Raytheon/GD	Hercules	Raytheon/GD
Sparrow 3-7M	USN/USAF	D,P	Raytheon	Hercules	Raytheon
AIR-TO-SURFACE					
ALCM	USAF	D	Boeing	Williams Research	McDonnell Douglas
HARM	USN/USAF	D	Texas Instr.	Thiokol	Texas Instr.
Harpoon	USN	P,O	McDonnell Douglas	Teledyne CAE	TI, IBM, LSI, Northrop
GBU-15	USAF	D	Rockwell	—	Rockwell
Maverick-65A/B	USAF	P, O	Hughes	Thiokol/Aerojet	—
Maverick-65D	USAF	R,D	Hughes	Thiokol/Aerojet	Hughes
Maverick-65E	USMC	R,D	Hughes	Thiokol/Aerojet	Hughes
Maverick-65F	USN	D	Hughes	Thiokol/Aerojet	Hughes
Shrike	USN/USAF	O	NWC/PMTC	Aerojet/ Hercules	Texas Instruments
SRAM	USAF	O	Boeing	Lockheed	Singer
Standard ARM	USAF/USN	O	GD	NOSIH	GD
Tomahawk 2 (MRASM)	USAF/USN	D	General Dynamics	Teledyne CAE	McDonnell Douglas
Walleye 1	USN	O	Martin Marietta/ Hughes	—	Martin Marietta/ Hughes

(Continued on next page)

MAJOR MISSILE PROJECTS (Continued)

Project	Agency	Status	Systems Contractor	Propulsion Manufacturer	Guidance Manufacturer
AIR TO SURFACE (Cont'd.)					
Walleye 1ER	USN	R,D	NAC	—	NAC
Walleve 2	USN	O	NAC	—	NAC
Walleye 2 (ER/DL)	USN	O	NAC	—	NAC
ANTI-SUBMARINE					
Subroc	USN	O	Goodyear Aerospace	Thiokol	Singer
SURFACE-TO-AIR					
Chaparral	Army	O	Ford Aerospace	Hercules/ Bermite	GE/Raytheon
Improved Chaparral	Army	P,O	Ford Aerospace	—	Ford Aerospace
Improved Hawk	Army	P,O	Raytheon	Aerojet	Raytheon
Patriot	Army	P	Raytheon	Thiokol	Raytheon
RAM	USN	D	General Dynamics	Bermite/ Hercules	General Dynamics
Redeye	Army	O	General Dynamics	Atlantic Research	General Dynamics
Roland	Army	P	Hughes/ Boeing	Hercules	Hughes/ Boeing
Sea Sparrow	USN	O	Raytheon	Aerojet/ Hercules	Raytheon
Standard MR (SM-1)	USN	P,O	General Dynamics	Aerojet/ Hercules	General Dynamics
Standard MR (SM-2)	USN	P,O	General Dynamics	Aerojet/ Hercules	General Dynamics
Standard ER (SM-1)	USN	P,O	General Dynamics	Atlantic Research	General Dynamics
Standard ER (SM-2)	USN	P,O	General Dynamics	Atlantic Research	General Dynamics
Stinger	Army/ USMC	P,O	General Dynamics	Atlantic Research	General Dynamics
Talos	USN	P,O	Bendix	Bendix	Bendix
Tartar	USN	O	GD	Aerojet	GD
Terrier	USN	O	General Dynamics	Atlantic Research	General Dynamics
SURFACE-TO-SURFACE					
Minuteman 2	USAF	O	AFLC Hill AFB	Thiokol/ Aerojet/ Hercules	Rockwell Autonetics

(Continued on next page)

MAJOR MISSILE PROJECTS (Continued)

Project	Agency	Status	Systems Contractor	Propulsion Manufacturer	Guidance Manufacturer
SURFACE-TO-SURFACE (Cont'd.)					
Minuteman 3	USAF	O	AFLC Hill AFB	Thiokol/ Aerojet	Rockwell Autonetics
MX	USAF	R,D	BMO/TRW	Thiokol/ Aerojet/ Hercules/ Rocketdyne	Autonetics/ Northrop
Polaris A3	USN	O	Lockheed MSC	Aerojet/ Hercules	GE/Hughes/ MIT/Raytheon
Poseidon C3	USN	O	Lockheed MSC	Thiokol/ Hercules	GE/MIT/ Raytheon/ Hughes
Tomahawk (SLCM)	USN	P	General Dynamics	Williams Research	McDonnell Douglas
Tomahawk (GLCM)	USAF	D	General Dynamics	Williams Research	McDonnell Douglas
Titan 2	USAF	O	AFLC Hill AFB	Aerojet	GM/Delco Electronics
Trident C4	USN	P,O	Lockheed MSC	Hercules/ Thiokol	GE/Draper/ Raytheon/ Hughes
BATTLEFIELD SUPPORT AND ANTIARMOR					
Copperhead	Army	P	Martin Marietta	—	—
Dragon	Army	P,O	Raytheon/ Kollsman	McDonnell Douglas/ Hercules	Raytheon
Hellfire	Army	D	Rockwell	Thiokol	Martin Marietta
Lance	Army	O	Vought	RI/ Rocketdyne	E-Systems/ Sys-Donner/Arma
Pershing 1A	Army	O	Martin Marietta	Thiokol	Bendix
Pershing 2	Army	D	Martin Marietta	Hercules	Goodyear Aerospace
Shillelagh	Army	O	Ford Aerospace	Hercules	Ford Aerospace
TOW	Army	P,O	Hughes	Hercules	Emerson Electric

Source: Aerospace Industries Association, based on information from "Aviation Week & Space Technology Magazine."
Status: R—Research; D—Development; P—Production; O—Operational

DEPARTMENT OF DEFENSE OUTLAYS FOR MISSILES

Fiscal Years 1960–1982
(Millions of Dollars)

Year	TOTAL MISSILE OUTLAYS	Procurement	Research, Development, Test and Evaluation
1960	$ 5,086	$ 3,027	$ 2,059
1961	5,997	2,972	3,025
1962	6,219	3,442	2,777
1963	6,058	3,817	2,241
1964	5,929	3,577	2,352
1965	3,997	2,096	1,901
1966	3,870	2,069	1,801
1967	4,432	1,930	2,502
1968	4,741	2,219	2,522
1969	4,919	2,509	2,410
1970	5,108	2,912	2,196
1971	5,148	3,140	2,008
1972	5,166	3,009	2,157
1973	5,061	3,023	2,038
1974	5,141	2,981	2,160
1975	5,065	2,889	2,176
1976	4,591	2,296	2,295
Tr. Qtr.	922	402	520
1977	5,040	2,781	2,259
1978	NA	1,794	NA
1979	NA	2,084	NA
1980	NA	2,461	NA
1981[E]	NA	3,159	NA
1982[E]	NA	4,077	NA

Source: Department of Defense Budget (Annually).
E Estimate.
NA Not Available.

DEPARTMENT OF DEFENSE
OUTLAYS FOR MISSILE PROCUREMENT

By Agency
Fiscal Years 1960-1982
(Millions of Dollars)

Year	TOTAL MISSILE PROCUREMENT	Air Force	Navy	Army
1960	$ 3,027	$ 2,021	$ 423	$ 583
1961	2,972	1,922	493	557
1962	3,442	2,385	593	464
1963	3,817	2,676	718	423
1964	3,577	2,100	981	496
1965	2,096	1,320	522	254
1966	2,069	1,313	512	244
1967	1,930	1,278	432	220
1968	2,219	1,388	436	395
1969	2,509	1,382	534	593
1970	2,912	1,467	702	743
1971	3,140	1,497	791	852
1972	3,009	1,334	831	844
1973	3,023	1,454	628	941
1974	2,981	1,537	541	903
1975	2,889	1,602	615	672
1976	2,296	1,549	584	163
Tr. Qtr.	402	347	148	(93)
1977	2,781	1,502	905	374
1978	1,794	1,376	NA	418
1979	2,084	1,537	NA	547
1980	2,461	1,810	NA	651
1981[E]	3,159	2,078	NA	1,081
1982[E]	4,077	2,818	NA	1,259

Source: Department of Defense Budget (Annually)
E Estimate
NA Not Available

SALES AND BACKLOG
MISSILE SYSTEMS AND PARTS
Calendar Years 1961-1980
(Millions of Dollars)

Year	Missile Systems and Parts[a]	
	Net Sales	Backlog December 31
1961	$ 3,628	$ 2,873
1962	3,699	2,143
1963	3,318	2,146
1964	2,580	1,921
1965	2,082	2,394
1966	2,260	2,157
1967	2,877	3,121
1968	2,812	3,218
1969	2,676	2,511
1970	2,826	2,721
1971	2,641	3,344
1972	3,335	3,642
1973	3,391	3,868
1974	3,454	4,473
1975	3,548	4,580
1976	3,237	4,379
1977	3,118	4,541
1978	3,264[b]	4,581
1979[r]	3,706	4,916
1980	3,619	5,823

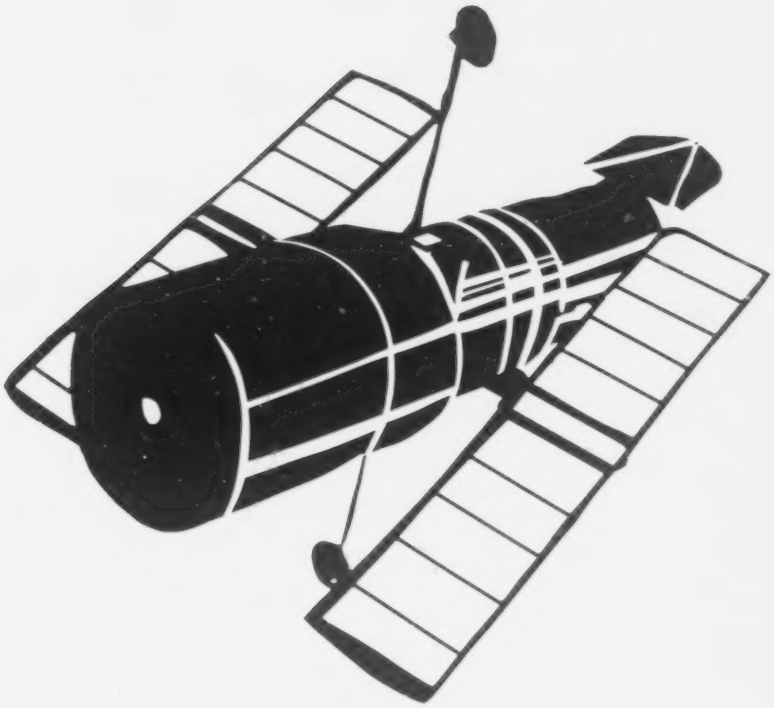
Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quarterly).
a Prior to 1980, includes space vehicle systems and parts sold to other than U.S. Government customers.
b AIA estimate based on MQ37D.
r Revised.

SALES AND BACKLOG
ENGINES AND PROPULSION UNITS FOR
MISSILES AND SPACE VEHICLES

Calendar Years 1961-1980
(Millions of Dollars)

Year	Net Sales			Backlog, December 31		
	TOTAL	Military[a]	Non-Military	TOTAL	Military[a]	Non-Military
1961	$ NA	$ 784	$ [b]	$ NA	$ 367	$ [b]
1962	NA	1,060	[b]	NA	498	[b]
1963	1,675	1,153	522	888	699	189
1964	1,579	851	728	1,024	557	467
1965	1,288	560	728	883	513	370
1966	1,211	511	700	859	534	325
1967	978	441	537	609	405	204
1968	907	676	231	535	406	129
1969	702	667	35	497	485	12
1970	640	398	242	617	610	7
1971	605	596	529	520	513	7
1972	607	596	11	671	659	12
1973	627	607	20	625	615	10
1974	649	633	16	678	662	16
1975	643	626	17	531	517	14
1976	641	621	20	673	659	14
1977	787	757	30	613	595	18
1978	792	760	32	788	754	34
1979[r]	952	915	37	1,024	980	44
1980	910	633	277	1,184	820	364

Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quarterly).
a Prior to 1980, includes figures for nonmilitary U.S. Government customers.
b Data included in totals for space vehicle systems. See page 72.
r Revised.
NA Not Available.



SPACE PROGRAMS

U.S. space activity, in decline for more than a decade, approached an all-time low in 1980. Including NASA and military payloads, together with satellites launched by NASA for other agencies, the number of successful U.S. launches totaled only 12. Only in 1958/59, the first two years of the space program, were there fewer successful launches—seven in 1958 and 11 in 1959—and in both those years total launch attempts (including failures) topped the 1980 score.

Worldwide space launch activity approximately matched that of the previous year; there were 105 launches in 1980 compared with 106 in 1979. The Soviet Union boosted 89 spacecraft, Japan two and India one. The all-time total of payloads delivered to Earth orbit or deep space trajectory reached 2,142, of which 1,339—more than 62 percent—were launched by the USSR. The U.S. launch total at year-end was 756.

NASA conducted seven launches during the year, but only one of them was a NASA payload; the others were launched for commercial sponsors or other government agencies who reimbursed NASA for launch costs. NASA's sole flight project was the Solar Maximum Mission spacecraft, launched February 14 to study solar

flares and their impact on Earth's environment.

NASA's other launches involved two commercial communications satellites, two military comsats and two environmental satellites. The latter, launched for the National Oceanic and Atmospheric Administration, were NOAA 7 (May 29), which failed to achieve useful orbit, and the GOES 4 (Geostationary Orbiting Environmental Satellite) launched September 9 as the initial member of a new GOES series intended to replace earlier satellites.

The two military satellites launched by NASA were FLTSATCOM 3 (January 20) and FLTSATCOM 4 (October 30). They were the third and fourth of a four-satellite USAF/Navy communications network. The commercial comsats launched were SBS-1 (November 15), the first of three Satellite Business System spacecraft designed to provide a new range of business communications, and Intelsat V F-2 (December 6), the first of nine new high-capacity satellites to be operated by the International Telecommunications Satellite Organization.

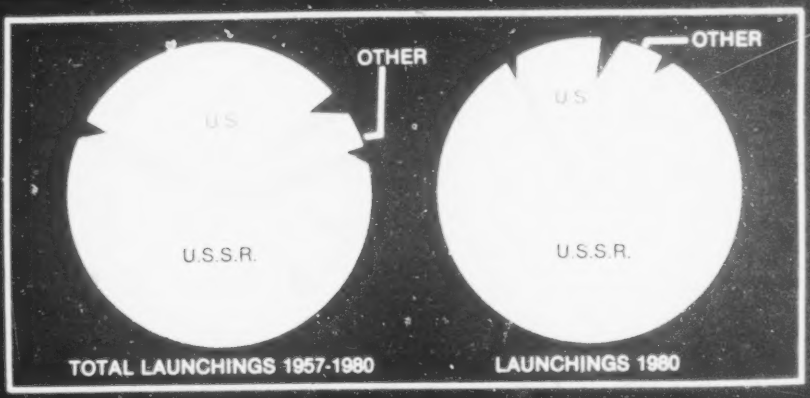
The other six U.S. launches of the year were conducted by the Air Force. The USAF launched Navstar 5 (February 9) and Navstar 6 (April 26), part of the interim Navstar Global Positioning System (GPS) designed to provide precise positioning information for naval, air and ground forces.

Chief among NASA/Department of Defense space development programs is the Space Shuttle, which completed preflight testing in 1980 and was moved to the launch pad on December 29 preparatory to initial launch (Note: The Shuttle Orbiter *Columbia* successfully completed its first orbital flight on April 14, 1981).

Among other NASA programs in development at year-end were the Space Telescope, an advanced astronomical observatory capable of peering seven times farther into space than the largest Earth-based telescopes; the International Solar Polar Mission, a NASA/European Space Agency program to investigate the still-unexplored "third dimension" of space by flying around the Sun's poles rather than in the plane of the ecliptic where all previous spacecraft have operated; the Venus Orbiting Imaging Radar, a spacecraft designed for detailed, high-resolution radar mapping of the planet Venus; and the National Oceanic Satellite System, a remote sensing system for collecting oceanographic data to satisfy both civil and defense needs.

Among the unclassified military space programs—in addition to the Space Shuttle and Navstar GPS—are the Air Force Satellite Communications System (AFSATCOM), a multisatellite system for worldwide, survivable command and control communications; the Defense Meteorological Satellite Program (DMSP), a two-satellite polar orbiting system intended to supply specialized meteorological data to support strategic missions; and the Defense Satellite Communications System (DSCS).

SPACECRAFT LAUNCHINGS 1957-1980



SPACECRAFT LAUNCHINGS WHICH ATTAINED EARTH ORBIT OR BEYOND 1957-1980

Country	Total 1957-1980	1976	1977	1978	1979	1980
TOTAL	2,142	126	124	124	106	105
U.S.S.R.	1,339	94	96	88	87	89
United States	756	29	24	32	16	13
France	10	—	—	—	—	—
Japan	17	1	2	1	2	2
Italy	5	—	—	—	—	—
People's Republic of China	5	2	—	1	—	—
Australia	1	—	—	—	—	—
United Kingdom	1	—	—	—	—	—
European Space Agency	1	—	—	—	1	—
India	1	—	—	—	—	1

NASA MAJOR LAUNCH RECORD, 1980

Date and Designation	Objectives and Remarks
Jan. 18 Fltsatcom 3	Third of a series of fleet communications satellites, for USAF narrow-band and wide-band communications and for USN fleet relay and broadcast channels.
Feb. 14 Solar Maximum Mission (SMM)	To observe solar flares or other active-sun phenomena, simultaneously using five or six SMM experiments, and to measure total radiative output of sun over six-month period.
May 29 NOAA 7	Third in a series of operational environmental monitoring satellites launched by NASA for National Oceanic and Atmospheric Administration (NOAA), for earth scanning, collection of remote observations, solar particle radiation measurements, atmospheric soundings, and data dissemination. Launch vehicle malfunction placed spacecraft in highly elliptical rather than planned circular orbit, and attempts to correct orbit unsuccessful; spacecraft unable to operate effectively, and replacement planned.
Sept. 9 GOES 4	Fourth in a series of operational spacecraft funded by National Oceanic and Atmospheric Administration (NOAA); first of a three-satellite series to replace initial three operational satellites. To provide near-continual, high-resolution visual and infrared imaging over North and South America and surrounding oceans, to collect environmental data from up to 10,000 remote-observing platforms, to measure energetic solar field, and to broadcast centrally prepared weather and satellite information. Successfully launched by NASA and turned over to NOAA for operational use.

(Continued on next page)

NASA MAJOR LAUNCH RECORD, 1980 (Continued)

Date and Designation	Objectives and Remarks
Oct. 31 Fltsatcom 4	Fourth of a series of planned fleet communications satellites, for USAF narrow-band and wide-band communications and for USN fleet relay and broadcast channels.
Nov. 15 SBS 1	First in a series of three communications satellites built for Satellite Business Systems (SBS), to provide integrated, all-digital, interference-free transmission of telephone, computer, electronic mail, and video teleconferencing to SBS business and industrial clients. First U.S. domestic commercial communications satellite to use higher, less congested 12- to 14- gigahertz (K-band) frequencies. Operational control turned over to SBS.
Dec. 6 Intelsat V F-2	First in a new series of nine satellites to be launched by NASA for the 105-member-nation International Telecommunications Satellite Organization (INTELSAT). Expected to operate as system's primary Atlantic Ocean spacecraft, to provide 12,000 voice circuits plus two television channels simultaneously. First three-axis-stabilized Intelsat satellite.

Source: National Aeronautics and Space Administration, "Aeronautics and Space Report of the President" (Annually).

U.S. APPLICATIONS SATELLITES
1980

Launch Date	Name and Launch Vehicle	Remarks
COMMUNICATIONS SATELLITES		
Jan. 18	Fltsatcom 3 Atlas-Centaur	Third in a DoD series.
Oct. 31	Fltsatcom 4 Atlas-Centaur	Fourth in a DoD series.
Nov. 15	SBS 1 Delta (TAT)	Launched for Satellite Business Systems as part of their domestic communications links.
Dec. 6	Intelsat V (F-2) Atlas-Centaur	First of a new series, positioned over the Atlantic.
WEATHER OBSERVATION		
May 29	NOAA 7 Atlas F	Failed to achieve useful orbit.
Sept. 9	GOES 4 Delta (TAT)	Fourth of this series for NOAA.
NAVIGATION		
Feb. 9	Navstar 5 Atlas F	Global Positioning System satellite.
Apr. 26	Navstar 6 Atlas F	Global Positioning System satellite.

Source: National Aeronautics and Space Administration, "Aeronautics and Space Report of the President," (Annually).

U.S.—LAUNCHED SCIENTIFIC PAYLOAD
1980

Launch Date	Name and Launch Vehicle	Remarks
Feb. 14	SMM Delta (TAT)	Solar Maximum Mission.

Source: National Aeronautics and Space Administration, "Aeronautics and Space Report of the President," (Annually).

DEPARTMENT OF DEFENSE SPACE PROGRAMS[a]
PROCUREMENT (INCLUDING INITIAL SPARES) AND RDT&E
Fiscal Years 1980, 1981 and 1982
(Millions of Dollars)

Agency and Program	1980		1981[E]		1982[E]	
	Procurement	RDT&E	Procurement	RDT&E	Procurement	RDT&E
AIR FORCE						
Afsatcom	$ 28.5	$ 17.7	$ 27.8	$ 36.5	$ —	$ 56.2
Defense Meteorological Satellite Program (DMSP)	29.4	17.8	47.5	19.0	39.9	48.3
Defense Satellite Communications System (DSCS)	18.0	24.0	79.8	33.2	136.9	35.2
Navstar Global Positioning System	—	135.3	—	126.6	78.6	170.1
*Space Defense System	—	82.3	—	110.2	—	147.4
Space Launch Support	21.9	—	46.7	3.5	97.6	15.0
Space Shuttle	163.2	205.9	136.0	243.1	225.3	272.3
Space Boosters	44.0	25.7	76.2	29.5	65.4	14.6
NAVY						
Fleet Satellite Communications (Fltsatcom)	$ 28.3	$ 17.0	$ 30.0	$ 5.1	$ —	$ 12.6
ARMY						
*Navstar Global Positioning System[b]	$ —	$ 33.2	$ —	$ 41.3	$ —	$ 73.3

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually).
a Total Obligational Authority.
b Includes Army and Navy.
E Estimate.
* Programs in R&D only.

UNITED STATES SPACE LAUNCH VEHICLES AS OF 1980

Vehicle	Stages	Thrust (in Kilo-newtons)	Payload (kg)	
			555 Km. Orbit	Escape
Scout	1. Algol IIIA*	481.0	186	38.6
	2. Castor IIA*	281.0		
	3. Antares III*	83.1		
	4. Altair III*	26.2		
Delta 2900 Series	1. Thor plus 9 TX 354-5*	911.9 440.4	1,769	476
	2. Delta (DSV-3)	45.8		
	3. TE 364-4*	66.7		
Atlas F/TE 364-4	1. Atlas Booster and Sustainer	1,970.6	1,497	—
	2. TE 364-4*	66.7		
Atlas-Agena	1. Atlas Booster and (SLV-3A)	2,237.5	2,722	454
	2. Agena	71.2		
Atlas-Centaur	1. Atlas Booster and Sustainer	1,912.0	4,500	1,450
	2. Centaur	133.4		
Titan IIIB-Agena	1. LR-87	2,353.1	3,614-3,727	—
	2. LR-91	444.8		
	3. Agena	71.2		
Titan IIIC	1. Two 5-segment 3.05-m. dia.*	10,413.3	—	1,464
	2. LR-87	2,353.1		
	3. LR-91	444.8		
	4. Transtage	71.2		
Titan III (23) D	1. Two 5-segment 3.05-m. dia.*	10,413.3	11,182	—
	2. LR-87	2,353.1		
	3. LR-91	444.8		
Titan III (34) D	1. Two 5½-segment 3.05-m. dia.*	11,555.6	12,545	—
	2. LR-87	2,353.1		
	3. LR-91	444.8		
Titan III (34)D/IUS	1. Two 5½-segment 3.05-m. dia.*	11,555.6	1,818	1,818
	2. LR-87	2,353.1		
	3. LR-91	444.8		
	4. IUS 1st Stage*	191.3		
	5. IUS 2nd Stage*	71.2		
Thor LV-2F	1. Thor	756.2	512	—
	2. TE 364-4*	66.7		
	3. TE 364-15*	44.5		
Thor SLV-2A/ Block 5D-2	1. Thor plus 3 TX 354-5*	756.2 689.5	653	—
	2. TE 364-4*	66.7		
	3. TE 364-15*	44.5		

Source: NASA, "Aeronautics and Space Report of the President" (Annually).

* Solid propellant, all others are liquid.

CHRONOLOGY OF MANNED SPACE FLIGHTS

Calendar Years 1979–1980

Launch Date	Project	Pilots	Nation	Flight Duration
1979				
Feb. 25	Soyuz 32	Vladimir Lyakhov Valeriy Ryumin	USSR	2,596 hr. 24 min.
Apr. 10	Soyuz 33	Nikolay Rukavishnikov Georgiy Ivanov	USSR	47 hr. 01 min.
June 6	Soyuz 34	(unmanned at launch; returned with Soyuz 32 crew)	USSR	1,770 hr. 17 min.
1980				
Apr. 9	Soyuz 35	Leonid Popov Valeriy Ryumin (returned in Soyuz 37)	USSR	1,321 hr. 29 min.
May 26	Soyuz 36	Valeriy Kubasov Bertalan Farkas[c] (returned in Soyuz 35)	USSR	1,580 hr. 54 min.
June 5	Soyuz T-2	Yuriy Malyshev Vladimir Aksenov	USSR	94 hr. 21 min.
July 23	Soyuz 37	Viktor Gorbatko Pham Tuan[d] (returned in Soyuz 36)	USSR	1,911 hr. 17 min.
Sept. 18	Soyuz 38	Yuriy Romanenko Arnaldo Tamayo Mendez[e]	USSR	188 hr. 43 min.
Nov. 27	Soyuz T-3	Leonid Kizim Oleg Makarov Gennadiy Strekalov	USSR	307 hr. 8 min.

Source: NASA, "Aeronautics and Space Report of the President" (Annually).
NOTE: Data for earlier years in previous editions of "Aerospace Facts and Figures."
a First Polish Cosmonaut.
b First German Democratic Republic Cosmonaut.
c First Hungarian Cosmonaut.
d First Vietnamese Cosmonaut.
e First Cuban Cosmonaut.

U.S. MANNED SPACE FLIGHT TIME LOG

Launch Date	Mission	Man-Hours in Mission		Total Cumulative Time	
		Hrs.	Min.	Hrs.	Min.
1961					
May 5	MR-3 (Shepard)	—	15	—	15
July 21	MR-4 (Grissom)	—	16	—	31
1962					
Feb. 20	MR-6 (Glenn)	4	55	5	26
May 24	MA-7 (Carpenter)	4	56	10	22
Oct. 3	MA-8 (Schirra)	9	13	19	35
1963					
May 15	MA-9 (Cooper)	34	20	53	55
1965					
Mar. 23	Gemini 3 (Grissom, Young)	9	46	63	41
June 3	Gemini 4 (McDivitt, White)	195	52	259	33
Aug. 21	Gemini 5 (Cooper, Conrad)	381	50	641	23
Dec. 15	Gemini 6 (Schirra, Stafford)	51	42	693	05
Dec. 4	Gemini 7 (Borman, Lovell)	661	10	1,354	15
1966					
Mar. 16	Gemini 8 (Armstrong, Scott)	21	21	1,375	36
June 3	Gemini 9 (Stafford, Cernan)	144	42	1,520	32
July 18	Gemini 10 (Young, Collins)	141	34	1,662	06
Sept. 12	Gemini 11 (Conrad, Gordon)	142	34	1,804	40
Nov. 11	Gemini 12 (Lovell, Aldrin)	189	10	1,993	50
1968					
Oct. 11	Apollo 7 (Schirra, Eisele, Cunningham)	780	27	2,774	17

(Continued on next page)

U.S. MANNED SPACE FLIGHT TIME LOG (Continued)

Launch Date	Mission	Man-Hours in Mission		Total Cumulative Time	
		Hrs.	Min.	Hrs.	Min.
Dec. 21	Apollo 8 (Borman, Lovell, Anders)	441	03	3,215	20
1969					
Mar. 3	Apollo 9 (McDivitt, Scott, Schweikart)	723	03	3,938	23
May 18	Apollo 10 (Stafford, Young, Cernan)	576	09	4,514	32
July 16	Apollo 11 (Armstrong, Collins, Aldrin)	585	57	5,100	29
Nov. 14	Apollo 12 (Conrad, Gordon, Bean)	733	48	5,834	17
1970					
Apr. 11	Apollo 13 (Lovell, Haise, Swigert)	428	45	6,623	02
1971					
Jan. 31	Apollo 14 (Shepard, Roosa, Mitchell)	650	06	6,913	08
July 26	Apollo 15 (Scott, Worden, Irwin)	885	36	7,808	44
1972					
Apr. 16	Apollo 16 (Young, Duke, Mattingly)	797	33	8,606	17
Dec. 7	Apollo 17 (Cernan, Schmitt, Evans)	905	36	9,511	53
1973					
May 25	Skylab 2 (Conrad, Kerwin, Weitz)	2,018	30	11,530	29
July 28	Skylab 3 (Bean, Lousma, Garriott)	4,287	27	15,817	56
Nov. 16	Skylab 4 (Carr, Gibson, Pogue)	6,051	48	21,869	44
1975					
July 15	Apollo (ASTP) (Stafford, Slayton, Brand)	652	24	22,522	08

Source: NASA "Aeronautics and Space Report of the President" (Annually).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OUTLAYS

Fiscal Years 1960–1982
(Millions of Dollars)

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
1960	$ 401	$ 256	$ 54	$ 91
1961	744	487	98	159
1962	1,257	936	114	207
1963	2,552	1,912	225	416
1964	4,171	3,317	438	416
1965	5,093	3,984	531	578
1966	5,933	4,741	573	619
1967	5,426	4,487	289	650
1968	4,724	3,946	126	652
1969	4,251	3,530	65	656
1970	3,753	2,992	54	707
1971	3,382	2,630	44	708
1972	3,422	2,623	50	749
1973	3,315	2,541	45	729
1974	3,256	2,421	75	760
1975	3,266	2,420	85	761
1976	3,669	2,749	121	799
Tr. Qtr.	952	731	26	195
1977	3,945	2,980	105	860
1978	3,983	2,989	124	870
1979	4,196	3,139	133	925
1980	4,852	3,702	140	1,010
1981[E]	5,274	4,052	156	1,066
1982[E]	5,895	4,628	154	1,113

Source: "The Budget of the United States" (Annually).
E Estimate

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION BUDGET AUTHORITY

Fiscal Years 1960–1982
(Millions of Dollars)

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
1960	$ 614	$ 333	$ 190	$ 91
1961	964	672	125	167
1962	1,825	1,285	326	214
1963	3,673	2,929	744	*a*
1964	5,099	3,890	713	496
1965	5,250	4,360	267	623
1966	5,175	4,502	61	612
1967	4,968	4,235	85	648
1968	4,589	3,912	38	639
1969	3,995	3,314	33	648
1970	3,749	2,993	53	703
1971	3,312	2,556	26	730
1972	3,308	2,523	53	732
1973	3,408	2,599	79	730
1974	3,040	2,194	101	745
1975	3,231	2,323	143	765
1976	3,552	2,678	82	792
Tr. Qtr.	932	700	11	221
1977	3,819	2,856	118	845
1978	4,064	3,012	162	890
1979	4,559	3,477	148	934
1980	5,243	4,088	159	996
1981[E]	5,523	4,336	115	1,071
1982[E]	6,122	4,903	105	1,114

Source: "The Budget of the United States" (Annually).
NOTE: Totals may not add because of rounding.
a Included in Research & Development for one year.
E Estimate.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION RESEARCH AND DEVELOPMENT PROGRAMS BUDGET AUTHORITY

Fiscal Year 1978–1982
(Millions of Dollars

	1978	1979	1980	1981[E]	1982[E]
TOTAL	$3,012	$3,477	$4,088	$4,336	$4,903
Space Transportation—TOTAL	1,752	2,012	2,385	2,734	3,136
Space Shuttle	1,349	1,638	1,871	2,003	2,194
Space Flight Operations	268	300	447	676	911
Expendable Launch Vehicles	135	74	67	54	31
Space Science—TOTAL	405	505	601	538	584
Physics and Astronomy	224	283	337	321	325
Planetary Exploration	147	182	220	176	215
Life Sciences	34	40	44	42	44
Space and Terrestrial Applications—TOTAL	224	284	344	338	378
Space Applications	235	275	332	332	373
Technology Utilization	9	9	12	7	5
Aeronautics and Space Technology—TOTAL	333	376	427	385	390
Aeronautical Research and Technology	228	264	308	272	265
Space Research and Technology	98	107	116	111	125
Energy Technology Applications	7	5	3	2	—
Space Tracking and Data Systems—TOTAL	278	300	332	341	415

Source: "The Budget of the United States," (Annually).
NOTE: Totals may not add because of rounding.
E Estimate.

SPACE ACTIVITIES BUDGET AUTHORITY

Fiscal Years 1959-1981[a]
(Millions of Dollars)

Year	TOTAL	NASA[b]	DOD	Energy	Other[c]
1959	$ 785	$ 261	$ 490	$ 34	$ —
1960	1,066	462	561	43	—
1961	1,808	926	814	68	—
1962	3,295	1,797	1,298	148	52
1963	5,435	3,626	1,550	214	45
1964	6,831	5,016	1,599	210	6
1965	6,956	5,138	1,574	229	15
1966	6,970	5,065	1,689	187	29
1967	6,742	4,830	1,664	184	64
1968	6,551	4,430	1,922	145	54
1969	5,976	3,822	2,013	118	23
1970	5,341	3,547	1,678	103	13
1971	4,741	3,101	1,512	95	33
1972	4,575	3,071	1,407	55	42
1973	4,825	3,093	1,623	54	55
1974	4,640	2,759	1,766	42	73
1975	4,914	2,915	1,892	30	77
1976	5,320	3,225	1,983	23	89
Tr. Qtr.	1,341	849	460	5	27
1977	5,983	3,440	2,412	22	109
1978	6,509	3,623	2,729	34	123
1979	7,419	4,030	3,211	59	119
1980[E]	8,872	4,697	4,003	54	118
1981[E]	10,074	4,989	4,911	51	123

Source: NASA, "Aeronautics and Space Report of the President" (Annually).
a FY 1982 and revised FY 1981 estimates not available at time of publication.
b Excludes amounts for air transportation.
c Departments of Commerce, Interior and Agriculture, and the National Science Foundation.

SALES AND BACKLOG
SPACE VEHICLE SYSTEMS[a]
(Excluding Engines and Propulsion Units)
Calendar Years 1961-1980
(Millions of Dollars)

Year	Net Sales			Backlog, December 31		
	TOTAL	Military	Non-Military	TOTAL	Military	Non-Military
1961	$ 775	$ 551	$ 224[b]	$ 586	$ 350	$ 236[b]
1962	1,319	712	607[b]	1,435	852	583[b]
1963	1,911	1,061	850	1,612	856	756
1964	2,222	732	1,490	1,611	391	1,220
1965	2,449	602	1,847	2,203	503	1,700
1966	2,710	734	1,976	1,494	428	1,066
1967	2,199	789	1,410	1,974	1,096	878
1968	2,357	899	1,458	1,329	834	495
1969	2,282	1,187	1,095	1,330	869	461
1970	1,956	1,025	931	1,184	786	398
1971	1,725	860	865	916	603	313
1972	1,656	905	751	959	646	313
1973	1,562	902	660	1,177	923	254
1974	1,751	944	807	1,492	1,131	361
1975	2,119	1,096	1,023	1,304	1,019	285
1976	2,002	904	1,098	1,234	902	332
1977	1,870	814	1,056	1,589	1,263	326
1978	2,324	1,006	1,318	2,188	1,693	495
1979[r]	2,539	1,105	1,434	1,448	909	539
1980	3,254	1,513	1,741	1,870	1,025	845

Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quarterly).

a Space vehicle systems and parts sold to other than U.S. Government customers included as of 1980; previously, this product group combined with missile systems and parts (see p. 55).

b Includes engines and propulsion units.

r Revised.

AIR TRANSPORTATION

After four consecutive years of setting traffic records, the U.S. scheduled airlines experienced 1980 declines in both passenger and cargo traffic. Reduced traffic volume, occasioned by higher fares and cargo rates, combined with still-climbing operating costs to erode the profit margin on domestic operations to $7 million, down from $130 million in 1979 and $1 billion in 1978. The profit squeeze was even more evident in international operations, and combined figures for all services provided by U.S. certificated airlines showed an operating loss in 1980 of $225 million, the worst in history. The Air Transport Association viewed traffic declines and growing cost pressures with special concern because of the airlines' need to generate large amounts of capital for acquisition of quieter, more fuel-efficient aircraft essential to productive operations in the 1980s and beyond.

U.S. airlines boarded 297 million passengers in 1980 and flew them 254 billion revenue passenger miles. The figures represent drops from the previous year of about six percent and three percent respectively. Cargo ton miles flown in 1980 amounted to 7.1

billion, down 1.7 percent from 1979. Despite the declines, 1980 totals in each category were higher than in any previous year except the all-time record year of 1979.

Among other statistical highlights of the U.S. scheduled airlines' 1980 performance:

- Domestic flights accounted for 92 percent of all passengers boarded, the same as in the previous year. The airlines carried 273 million passengers on domestic routes, a decline of almost seven percent from 1979.
- International traffic was closer to the previous year's volume. Passengers carried totaled 24 million, down less than one percent.

The Air Transport Association said that significant changes in U.S. scheduled airline traffic were not expected in 1981, but that improvement in the U.S. economy and greater stability in fuel prices could bring about a return to modest profit levels.

The U.S. air carrier fleet, including operators other than scheduled airlines, numbered 3,805 aircraft at the end of 1980, 200 more than at the end of 1979. More than 2,500 of the planes were turbojet-powered and almost 700—mostly twin-engine aircraft—were turboprop-powered.

Worldwide commercial air traffic did not decline, but the growth rate was significantly lower than in recent years. World scheduled airlines, excluding those of the Soviet Union, carried 634 million passengers, only one million more than in the previous year. Passenger miles totaled 562 billion, an increase of three billion or about one-half of one percent. Cargo ton-miles flown amounted to 18.2 billion, up more than three percent.

When Soviet Union traffic is included, the same picture emerges: volume was up in all categories in 1980, but the rate of gain was lower than in earlier years. Passengers carried worldwide totaled 745 million, an increase of 10 million; passenger miles, at 665 billion, were up 14 billion; and cargo ton-miles, at close to 20 billion, were up some 700 million or more than 3.7 percent over 1979.

The world fleet of turbine engine aircraft in commercial service continued to expand at about the rate of earlier recent years, according to the Air World Survey compiled for Exxon International by Aviation Data Services, Inc. Excluding airplanes operated by the Soviet Union, the commercial fleet numbered 8,010 as of mid-year 1980, 223 more than in the previous year. The breakdown included 5,590 jet-powered aircraft, 2,059 turboprops and 195 turbine-powered helicopters.

Planes of U.S. manufacture accounted for approximately 70 percent of the total of the world's turbine engine aircraft fleet and more than 85 percent of the jet transports. In terms of jet models in service, the Boeing 727 led with 1,560 units. Rounding out the top five were the McDonnell Douglas DC-9 (856 planes), the Boeing 737 (593), the Boeing 707 (569) and the Boeing 747 (420).

WORLD AIRLINE TRAFFIC SCHEDULED SERVICES

Calendar Years 1965–1980
(Millions)

Year	Miles Flown	Passengers Carried	Passenger-Miles	Cargo Ton-Miles	Mail Ton-Miles
	Excludes U.S.S.R.				
1965	2,550	177	123,000	3,290	755
1966	2,780	200	142,000	3,905	1,050
1967	3,280	233	169,500	4,470	1,295
1968	3,730	261	192,500	5,425	1,610
1969	4,170	293	218,000	6,685	1,720
1970	4,360	311	237,000	7,165	1,885
1971	4,390	333	252,000	7,870	1,750
1972	4,490	368	289,000	9,060	1,660
1973	4,680	405	323,000	10,680	1,700
1974	4,580	423	341,000	11,625	1,680
1975	4,670	436	357,000	11,810	1,660
1976	4,870	475	392,000	13,170	1,740
1977	5,030	517	429,000	14,620	1,830
1978[r]	5,280	581	495,000	16,170	1,880
1979[r]	5,630	633	559,000	17,600	1,970
1980[E]	5,790	634	562,000	18,180	2,120
	Includes U.S.S.R.				
1970	NA	382	286,000	8,230	2,110
1971	NA	411	307,000	9,060	1,970
1972	NA	450	348,000	10,290	1,900
1973	NA	489	385,000	12,015	1,970
1974	NA	515	407,000	13,030	1,970
1975	NA	534	433,000	13,260	1,990
1976	NA	576	473,000	14,690	2,080
1977	NA	610	508,000	16,180	2,180
1978[r]	NA	679	582,000	17,770	2,240
1979[r]	NA	735	651,000	19,210	2,350
1980[E]	NA	745	665,000	19,930	2,530

Source: International Civil Aviation Organization, "Development of World Scheduled Revenue Traffic" (Annually).

NOTE: Excludes states which were not members of ICAO on December 31, 1980. Figures represent revenue traffic on international and domestic scheduled services.

r Revised.
E Estimate.
NA Not Available.

WORLD AIRLINE FLEET
TURBINE-ENGINED AIRCRAFT
By Model
1976-1980

	1976	1977	1978	1979	1980
TOTAL AIRCRAFT IN SERVICE	7,195	7,298	7,550	7,787	8,010
Number Manufactured in U.S.	4,891	5,027	5,159	5,341	5,590
Percent Manufactured in U.S.	68.0%	68.9%	68.3%	68.6%	69.8%
Turbojets—TOTAL	5,012	5,137	5,288	5,534	5,756
Aerospatiale Caravelle	187	141	131	111	102
Aerospatiale Corvette	15	25	22	19	13
Airbus A300	24	35	53	76	102
B.Ae. 111	163	164	164	162	158
B.Ae. HS-125	7	6	5	5	6
B.Ae. VC-10	26	22	17	17	6
B.Ae./Aerospatiale Concorde	6	8	9	9	13
B.Ae. Comet	17	16	10	7	4
B.Ae. Trident	86	93	99	97	64
Boeing 707/720	719	702	673	638	569
Boeing 727	1,185	1,228	1,315	1,427	1,560
Boeing 737	436	464	498	555	593
Boeing 747	268	291	308	349	420
Cessna Citation	5	5	4	3	13
Convair 880/990	18	15	13	13	14
Dassault Falcon	—	45	47	36	33
Dassault Mercure	10	10	10	10	10
Fokker-VFW F.28	81	94	103	122	115
Gates Learjet	17	18	11	10	14
Gulfstream II	4	5	5	6	7
Gulfstream III	—	—	—	—	1
Ilyushin IL-62	26	26	32	39	41
Ilyushin IL-76T	—	—	—	—	6
Lockheed JetStar	1	1	1	1	1
Lockheed L-1011 TriStar	126	138	145	160	177
MBB Hansa HFB-320	—	—	—	—	6
McDonnell Douglas DC-8	482	468	450	396	382
McDonnell Douglas DC-9	758	774	794	836	856
McDonnell Douglas DC-10	218	234	248	276	307
Rockwell Sabreliner	—	2	2	1	2
Tupolev Tu. 124	—	—	—	—	2
Tupolev Tu. 134	59	60	66	68	82
Tupolev Tu. 154	13	15	17	26	33
VFW-Fokker 614	6	5	11	12	2
Yakovlev YAK-40	14	27	25	47	42

(Continued on next page)

WORLD AIRLINE FLEET
TURBINE-ENGINED AIRCRAFT (Continued)
By Model
1976–1980

	1976	1977	1978	1979	1980
Turboprops—TOTAL	1,914	1,856	1,931	2,013	2,059
Aerospatiale N.262 Mohawk 298	28	34	40	33	30
Antonov An.12	2	2	2	2	10
Antonov An.24/26	54	54	65	90	125
Antonov An.30	—	—	—	—	1
B.Ae. Britannia	23	26	14	9	10
B.Ae. HP Herald	29	29	32	36	34
B.Ae./HP/JA Jetstream	6	7	8	6	3
B.Ae. Vanguard	25	22	24	23	11
B.Ae. Viscount	104	90	86	91	84
B.Ae. Argosy	8	7	8	9	8
B.Ae. HS-748	128	122	138	133	141
Beech 99	136	111	110	118	107
Beech King Air	12	14	19	11	15
Beech 18-TP Conv.	8	6	6	6	5
Canadair CL-44	27	24	24	17	12
CASA C.212	—	2	6	9	9
Cessna 400 Srs. TP Conv.	—	—	1	1	2
Convair CV 580	81	79	79	92	90
Convair CV 600/640	48	24	25	29	39
Douglas DC-3	—	—	--	3	—
DHC-2 Turbo Beaver	6	11	7	14	11
DHC-6 Twin Otter	307	308	335	327	321
DHC-7 Dash 7	—	—	4	8	18
Embraer EMB-110	14	43	49	61	60
Fokker-VFW F.27/ Fairchild F.27 & FH.227	394	354	370	364	363
GAF Nomad	—	3	6	10	9
Grumman Gulfstream I	2	3	—	—	8
Grumman Mallard	1	1	—	—	—
Grumman Turbo Goose	2	2	2	2	—
Ilyushin IL-18	88	84	72	82	79
LET L-410	12	12	12	11	11
Lockheed L-188 Electra	102	96	87	86	89
Lockheed L-100 Hercules	32	40	36	44	41
McKinnon Turbo Goose Conv.	—	—	—	—	3
Mitsubishi MU-2	15	17	15	15	10
NAMC YS-11	123	125	126	121	112

(Continued on next page)

WORLD AIRLINE FLEET
TURBINE-ENGINED AIRCRAFT (Continued)
By Model
1976-1980

	1976	1977	1978	1979	1980
Turboprops (continued)					
Pilatus Turbo Porter	11	10	12	7	3
Piper PA-31T Cheyenne	2	1	2	1	1
Rockwell Turbo Commander	3	2	1	2	1
Saunders ST-27	7	4	2	2	11
Shorts Skyliner/Skyvan	35	32	29	21	22
Shorts 330	—	—	—	26	36
Swearingen Merlin	—	—	—	—	3
Swearingen Metro	14	31	47	81	108
Other	23	18	24	5	—
Turbine-Powered Helicopters—TOTAL	269	305	331	240	195
Aerospatiale Alouette	27	25	26	21	7
Aerospatiale Lama	10	—	8	—	—
Aerospatiale Puma	—	20	20	20	17
Aerospatiale Super Frelon	1	1	—	—	1
Aerospatiale/Westland SA 330	17	—	—	—	—
Aerospatiale/Westland SA 341	1	—	—	—	—
Bell 204	5	8	9	9	5
Bell 205	26	31	27	4	1
Bell 206	53	71	79	50	26
Bell 212	8	10	15	11	7
Bell 222	—	—	—	1	—
Fairchild Hiller F-1100	1	—	—	—	—
Fuji Bell 214	—	—	1	1	4
Hughes 500	50	74	76	63	72
M.B.B. Bo.105	6	6	6	5	4
MIL Mi. 8	—	—	—	—	3
Sikorsky S-55T	—	1	2	3	—
Sikorsky S-58T	17	14	12	10	8
Sikorsky S-61	34	39	45	38	35
Sikorsky S-62	2	2	2	—	—
Sikorsky S-64	3	3	3	—	—
Sikorsky S-76	—	—	—	4	5
Other	8	—	—	—	—

Source: Exxon International Company, "Air World Survey," (Annually)
NOTE: The "Air World Survey" covers the world's airlines with the exception of Aeroflot, the USSR national airline, and covers aircraft in service on June 30. Excludes air taxi operators. Effective 1979, excludes a number of companies operating smaller types of aircraft and not providing scheduled services.

AIRLINE TRAFFIC
UNITED STATES SCHEDULED AIRLINES
Calendar Years 1960–1980
(Millions)

Year	Miles Flown	Passengers Carried	Passenger-Miles	Cargo Ton-Miles[a]
1960	998	58	38,863	1,130
1961	970	58	39,831	1,331
1962	1,010	63	43,760	1,738
1963	1,095	71	50,365	1,714
1964	1,189	82	58,494	2,017
1965	1,354	95	68,676	2,764
1966	1,482	109	79,889	3,810
1967	1,834	132	98,484	4,522
1968	2,146	150	113,958	5,140
1969	2,385	159	125,414	5,788
1970	2,418	170	131,710	5,346
1971	2,379	174	135,652	5,964
1972	2,376	191	152,406	6,403
1973	2,448	202	161,957	6,492
1974	2,258	207	163,919	6,495
1975	2,241	205	162,810	6,200
1976	2,320	223	178,988	6,525
1977	2,419	240	193,219	6,976
1978	2,520	275	226,781	7,001
1979[r]	2,791	317	262,023	7,189
1980	2,814	297	254,180	7,069

Source: Civil Aeronautics Board, Data Systems Management Division.
NOTE: Figures represent total scheduled service excluding nonrevenue operations of U.S. international and domestic certificated route air carriers.
a Due to recent changes in "Air Carrier Traffic Statistics," "Mail Ton-Miles" have been included in "Cargo Ton-Miles," which now covers freight plus express revenue and U.S. mail ton-miles plus foreign mail ton-miles in scheduled and nonscheduled operations.
r Revised.

PASSENGER SERVICE
U.S. SCHEDULED AIRLINES
Calendar Years 1960–1980

Year	Domestic		International	
	Passenger Miles Flown (Millions)	Passengers Carried (Thousands)	Passenger Miles Flown (Millions)	Passengers Carried (Thousands)
1960	30,557	52,377	8,306	5,499
1961	31,062	52,712	8,769	5,699
1962	33,623	55,950	10,138	6,598
1963	38,457	63,925	11,905	7,513
1964	44,141	72,988	14,352	8,775
1965	51,887	84,460	16,789	10,195
1966	60,591	97,746	19,298	11,646
1967	75,487	118,669	23,259	13,424
1968	87,508	134,423	26,451	15,728
1969	95,946	142,340	29,468	16,848
1970	104,147	153,662	27,563	16,260
1971	106,294	156,098	29,358	17,569
1972	118,138	172,452	34,268	18,897
1973	126,217	183,272	35,640	18,936
1974	129,732	189,733	33,186	17,725
1975	131,728	188,746	31,082	16,316
1976	145,271	206,274	33,717	17,039
1977	156,609	222,283	36,610	18,043
1978	182,669	253,960	44,112	20,759
1979	208,891	292,700	53,132	24,163
1980	200,087	272,771	54,093	23,978

Source: Civil Aeronautics Board, Data Systems Management Division.
NOTE: Figures represent total scheduled passenger services excluding nonrevenue operations of certificated route air carriers.

U.S. DOMESTIC AIRLINES
TOTAL ASSETS AND INVESTMENT IN FLIGHT EQUIPMENT

Fiscal Years 1960–1980
(Millions of Dollars)

Year	TOTAL NET ASSETS[a]	Value of Flight Equipment				Investment in Flight Equipment as a Percent of Total Assets
		TOTAL Gross Value	Less: Depreciation	Plus: Construction Work In Process[b]	Equals: Net Value of Flight Equipment	
1960	$ 1,760	$ 2,174	$ 890	$ 90	$ 1,374	78.1%
1961	2,099	2,719	1,062	77	1,734	82.6
1962	2,273	3,006	1,183	52	1,875	82.4
1963	2,211	3,132	1,341	27	1,818	82.2
1964	2,415	3,383	1,402	48	2,029	84.0
1965	2,816	3,844	1,505	52	2,391	84.9
1966	3,747	4,520	1,646	107	2,981	79.6
1967	5,003	5,485	1,805	153	3,833	76.6
1968	6,294	6,936	2,044	204	5,096	76.6
1969	7,107	8,003	2,334	195	5,864	82.5
1970	7,417	8,546	2,814	298	6,030	81.3
1971	7,664	9,375	3,231	203	6,347	82.8
1972	8,017	9,813	3,484	200	6,529	81.4
1973	13,967	12,377	4,495	350	8,232	58.9
1974	14,979	13,288	4,846	194	8,636	57.7
1975	15,098	13,668	5,278	192	8,582	56.8
1976	15,452	14,398	6,376	189	8,211	53.1
1977	16,868	14,822	8,140	187	6,869	40.7
1978	20,745	16,127	8,799	3,367	10,695	51.6
1979[r]	24,902	16,515	9,746	6,029	12,798	51.4
1980	28,331	19,237	10,313	6,142	15,066	53.2

Source: Civil Aeronautics Board, Data Systems Management Division.
NOTE: 1960-1972: includes data for trunk and local service carriers only; international carriers, helicopter services and air taxi operators excluded.
1973 to date: Pan American Airlines is reclassified as a trunk carrier. Data include certificated trunk, local service, Alaskan, Hawaiian, regional, all-cargo, other carrier groups, and helicopters, except for 1980 when no helicopter services were performed. Commuters and air taxis excluded.

a Comprises net investment in buildings and ground equipment, flight equipment, working capital, etc.
b Beginning 1978, includes "ground property, equipment and other."
r Revised.

U.S. AIR CARRIER AIRCRAFT
TYPE OF AIRCRAFT, NUMBER OF ENGINES AND MODEL
As of December 31, 1976-1980

	1976	1977	1978	1979	1980
TOTAL	2,707	2,747	2,991	3,605	3,805
Turbojets—TOTAL	2,205	2,254	2,375	2,472	2,526
Four-Engine—TOTAL	583	543	533	507	441
Boeing 707/720	265	242	228	182	149
Boeing 747	105	107	116	131	144
B.Ae./Aerospatiale Concorde	—	—	—	9	—
Convair 880 (22)/990(30)	—	—	6	—	6
Lockheed L-1329	2	—	1	1	—
McDonnell Douglas DC-8	211	194	182	184	142
Three-Engine—TOTAL	1,022	1,074	1,166	1,256	1,347
Boeing 727	820	869	950	1,029	1,092
Lockheed L-1011	77	78	84	87	102
McDonnell Douglas DC-10	125	127	132	140	153
Twin-Engine—TOTAL	600	637	676	709	738
Airbus A-300B	—	4	6	12	19
Boeing 737	152	161	174	206	220
B.Ae.BAC 111	31	31	30	28	27
Dassault MD-20, Falcon	43	45	46	44	42
DeHavilland DH-125	3	2	2	—	—
Fokker F-28	—	—	—	—	5
Grumman G-1159	4	5	6	6	5
Hamburger Flugzeugbau HF-320	1	3	4	4	—
Israel Westwind 1123/1124	—	—	2	2	1
Learjet LR-23/LR-24	1	2	—	8	5
Learjet LR-25	8	9	17	6	7
Learjet LR-35	4	6	6	4	3
McDonnell Douglas DC-9	352	366	375	381	394
Rockwell NA-265	1	2	4	2	2
Sud Aviation SE210 Caravelle	—	1	4	6	5
Sud Aviation SN601	—	—	—	—	3
Turboprops—TOTAL	260	269	336	565	682
Four-Engine—TOTAL	69	63	81	81	92
Canadair CL44D	—	—	—	1	2
DeHavilland DHC-7	—	—	2	8	18
Lockheed 188 Electra	49	43	59	52	52
Lockheed 382/L-100 Hercules	20	20	20	20	20

(Continued on next page)

U.S. AIR CARRIER AIRCRAFT
TYPE OF AIRCRAFT, NUMBER OF ENGINES AND MODEL (Continued)

	1976	1977	1978	1979	1980
Twin-Engine—TOTAL	191	206	255	484	590
Beech BE99	3	—	1	85	87
Beech BE90	—	—	—	3	2
Beech BE 200	—	—	—	4	1
Cessna C212	—	—	—	—	2
Cessna C441	—	—	—	—	1
Convair 580	73	77	81	91	88
Convair 600/640	25	22	28	29	31
DeHavilland DHC-6	18	14	27	78	107
Embraer EMB110	—	—	—	4	34
Fairchild F-27	7	4	7	6	7
Fairchild FH-227	27	23	23	22	8
Fairchild Swearingen Sa-226	—	7	13	66	100
GAF N22/N24 Nomad	—	—	—	1	9
Grumman G-159	1	7	8	15	16
Handley Page HP-137	—	—	—	16	15
Hawker-Siddeley HS748	1	1	1	1	2
Nihon YS-11	23	22	20	18	22
Nord ND-262	12	24	30	24	22
Short SD-3	—	3	9	—	34
Short SC-7	—	—	7	—	2
Short SD-330	1	2	—	21	—
Piston-Engine, TOTAL	235	218	277	567	595
Four-Engine—TOTAL	40	36	52	58	73
DeHavilland DH-114	—	—	4	7	27
Douglas DC-4	1	1	2	4	5
Douglas DC-6	36	33	42	46	41
Douglas DC-7	2	1	—	—	—
Lockheed 1049	1	1	1	1	—
Other	—	—	3	—	—
Twin-Engine—TOTAL	184	181	217	509	522
Single-Engine—TOTAL	11	1	8	—	—
Helicopters—TOTAL	7	6	3	1	2

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation," (Annually).
NOTE: Effective 1978, includes certified route air carriers, supplemental air carriers (charters), and all aircraft over 12,500 pounds operated by air taxis, commercial operators and travel clubs. Effective 1979, includes multi-engine aircraft in passenger service of commuters.

SOURCES OF OPERATING REVENUE
TOTAL DOMESTIC OPERATIONS,[a] ALL AIR CARRIER SERVICES

Calendar Years 1960-1980
(Millions of Dollars)

Year	TOTAL Operating Revenues	Passenger[b]	Mail (Including subsidy)[c]	Express and Freight[b]	Excess Baggage	Other[d]
1960	$ 2,129	$ 1,860	$ 113	$ 103	$ 21	$ 32
1961	2,245	1,951	130	115	20	29
1962	2,498	2,168	139	136	20	35
1963	2,722	2,375	143	152	17	35
1964	3,095	2,701	149	182	17	46
1965	3,608	3,142	157	220	12	77
1966	4,070	3,534	162	251	6	117
1967	4,887	4,260	170	287	7	163
1968	5,606	4,913	182	343	9	159
1969	6,438	5,662	186	401	10	179
1970	7,131	6,246	205	461	12	207
1971	7,753	6,736	227	527	13	250
1972	8,652	7,565	230	596	13	248
1973	9,694	8,379	263	694	14	344
1974	11,545	9,758	264	759	17	747
1975	12,020	10,123	253	782	19	843
1976	13,901	11,856	294	933	22	796
1977	15,621	13,771	355	1,109	21	565
1978	18,184	15,507	266	1,325	23	1,063
1979[r]	21,652	18,720	387	1,456	28	1,061
1980	26,353	23,049	446	1,551	32	1,275

Source: Civil Aeronautics Board, Data Systems Management Division.
a Includes certificated domestic trunks, local service, Intra-Alaska, Intra-Hawaii, other carriers, all-cargo, regional carriers, and helicopters, except for 1980 when no helicopter services were performed. Commuters and air taxis excluded.
b Includes scheduled and chartered.
c Includes U.S. as well as foreign mail.
d Includes revenues not related to transport.
r Revised.

REVENUES AND EXPENSES
TOTAL DOMESTIC OPERATIONS,[a] ALL AIR CARRIER SERVICES

Calendar Years 1960–1980
(Millions of Dollars)

Year	TOTAL Operating Revenues	TOTAL Operating Expenses	Operating Profit
1960	$ 2,129	$ 2,091	$ 38
1961	2,245	2,244	1
1962	2,498	2,408	90
1963	2,722	2,580	142
1964	3,094	2,778	316
1965	3,608	3,165	443
1966	4,070	3,589	481
1967	4,887	4,476	411
1968	5,606	5,298	308
1969	6,438	6,156	282
1970	7,131	7,128	3
1971	7,753	7,496	257
1972	8,652	8,158	493
1973	9,694	9,200	494
1974	11,545	10,760	785
1975	12,020	11,902	117
1976	13,901	13,326	575
1977	15,821	15,164	657
1978	18,184	17,151	1,033
1979[r]	21,652	21,522	130
1980	26,353	26,346	7

Source: Civil Aeronautics Board, Data Systems Management Division.
[a] Includes certificated domestic trunks, local service, Intra-Alaska, Intra-Hawaii, other carriers, all cargo, regional carriers, and helicopters, except for 1980 when no helicopter services were performed.
[r] Revised.

ACTIVE CIVIL AIRCRAFT

as of December 31, 1960–1979

Year	TOTAL	TOTAL Air Carrier[a]	General Aviation Aircraft					
			TOTAL	Fixed-Wing Aircraft			Rotor-craft[b]	Other[c]
				Multi-Engine	Single-Engine			
					4-place & over	3-place & less		
1960	78,760	2,211	76,549	7,243	34,829	33,472	634	371
1961	82,853	2,221	80,632	8,401	38,206	32,800	798	427
1962	86,287	2,166	84,121	9,186	41,120	32,341	967	507
1963	87,267	2,179	85,088	9,695	42,647	30,977	1,171	588
1964	90,935	2,193	88,742	10,644	45,777	30,367	1,306	648
1965	97,741	2,299	95,442	11,977	49,789	31,364	1,503	809
1966	107,085	2,379	104,706	13,548	52,972	35,687	1,622	877
1967	116,781	2,595	114,186	14,651	56,865	39,675	1,899	1,096
1968	127,164	2,927	124,237	16,760	60,977	42,830	2,350	1,320
1969	133,814	3,008	130,806	18,111	63,703	45,001	2,557	1,434
1970	134,539	2,796	131,743	18,291	64,759	44,884	2,255	1,554
1971	133,869	2,721	131,148	17,855	64,464	44,792	2,352	1,685
1972	147,695	2,685	145,010	19,849	70,998	49,448	2,787	1,928
1973	156,207	2,667	153,540	21,929	74,831	51,386	3,143	2,251
1974	164,160	2,658	161,502	23,418	78,924	53,008	3,610	2,542
1975	171,156	2,681	168,475	24,559	82,621[r]	54,390	4,073	2,832
1976	180,854	2,550	178,304	25,684	88,211	56,730	4,505	3,174
1977	186,767	2,473	184,294	26,652	91,960	57,340	4,726	3,616
1978	201,323	2,545	198,778[d]	28,782	101,466	59,185	5,315	4,028
1979	214,004	3,669	210,335	31,311	106,028	62,362	5,864	4,770

Source: Federal Aviation Administration, "Census of U.S. Civil Aircraft" (Annually)

NOTE: Before 1971, an active aircraft was one certificated as eligible to fly. Currently, an "active aircraft" must have a current registration and have been flown during the previous calendar year.

a Registered, not necessarily in operation. Includes helicopters.

b Includes autogiros; excludes air carrier helicopters.

c Includes gliders, dirigibles and balloons.

d Detail does not add to total because of estimating procedures.

r Revised.

ACTIVE AIRMAN CERTIFICATES HELD

As of December 31, 1976–1980

	1976	1977	1978	1979	1980
Pilots—TOTAL	744,246	783,932	798,833	814,667	827,071
Students	188,801	203,510	204,874	210,180	199,833
Private	309,005	327,424	337,644	343,276	357,479
Commercial	187,801	188,763	185,833	182,097	183,442
Airline Transport	45,072	50,149	55,881	63,652	69,569
Helicopter (only)	4,804	4,819	4,874	5,218	6,030
Glider (only)[a,b]	5,789	6,208	6,541	6,796	7,039
Other Pilot[a,b]	2,974	3,059	3,186	3,448	3,679
Non-Pilots—TOTAL	334,681	348,584	362,350	377,213	393,486
Mechanics[a]	212,303	220,768	228,743	237,611	250,157
Parachute Rigger[a]	8,718	8,994	9,200	9,381	9,547
Ground Instructor[a]	53,464	55,717	57,738	59,680	61,550
Dispatcher[a]	5,838	5,972	6,161	6,446	6,799
Control Tower Operator	24,584	25,107	25,388	25,232	25,130
Flight Navigator	2,214	2,155	2,092	1,994	1,936
Flight Engineer	27,560	29,871	33,028	36,869	38,367
Flight Instructor Certificates[c]	46,236	49,362	52,201	54,398	60,440
Instruments Ratings[c]	211,364	226,334	236,312	247,096	260,461

Source: Federal Aviation Administration, Office of Management Systems.

a No periodic medical examination required; therefore, no determination as to current activity can be made.

b Glider and lighter-than-air pilots are not required to have a medical examination; however, the totals above are the pilots who received a medical.

c Special ratings shown on pilot certificates represented above, not additional certificates.

GENERAL AVIATION
MILES AND HOURS FLOWN
By Type of Flying
Calendar Years 1965–1979

Year	TOTAL	Business		Commercial		Instructional		Personal & Other	
		Units	Per-cent	Units	Per-cent	Units	Per-cent	Units	Per-cent
MILES FLOWN BY TYPE OF FLYING—Millions of Miles									
1965	2,562	1,204	47%	461	18%	359	14%	538	21%
1966	3,336	1,536	46	516	16	646	19	638	19
1967	3,440	1,431	42	569	16	713	21	727	21
1968	3,701	1,406	38	666	18	814	22	815	22
1969	3,926	1,426	36	723	19	910	23	867	22
1970	3,207	1,134	35	555	17	686	22	832	26
1971	3,143	1,129	36	506	16	651	21	857	27
1972	3,317	1,144	34	581	18	692	21	900	27
1973	3,729	1,344	36	688	18	778	21	919	25
1974	4,043	1,433	35	790	20	816	20	1,004	25
1975	4,238	1,487	35	818	19	829	20	1,104	26
1976	4,476	1,563	35	885	20	873	20	1,155	26
1977	NA	NA	NA	NA	NA	NA	NA	NA	NA
1978	NA	NA	NA	NA	NA	NA	NA	NA	NA
1979	NA	NA	NA	NA	NA	NA	NA	NA	NA
HOURS FLOWN BY TYPE OF FLYING—Thousands of Hours									
1965	16,733	5,857	35%	3,348	20%	3,346	20%	4,182	25%
1966	21,023	7,057	33	3,555	17	5,674	27	4,737	23
1967	22,153	6,578	30	3,918	18	6,262	28	5,395	24
1968	24,053	6,976	29	4,810	20	6,494	27	5,773	24
1969	25,351	7,064	28	4,928	19	7,023	28	6,336	25
1970	26,030	7,204	28	4,582	18	6,791	26	7,453	28
1971	25,512	7,141	28	4,264	17	6,416	25	7,691	30
1972	26,974	7,239	27	4,831	18	6,814	25	8,090	30
1973	30,048	8,558	28	5,608	19	7,646	25	8,236	28
1974	32,475	9,140	28	6,294	19	7,972	25	9,069	28
1975	34,165	9,545	28	6,480	19	8,174	24	9,966	29
1976	36,128	10,095	28	7,029	19	8,591	24	10,413	29
1977	35,792	10,309	29	6,641	19	9,322	26	9,332	26
1978[a]	39,409	12,896	33	7,192	18	8,293	21	10,909	28
1979	43,340	13,980	32	8,064	19	10,668	25	10,523	24

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation" (Annually).
NA Not Available.
a Detail does not add to total because of estimating procedures.

U.S. CIVIL AIRPORTS[a]

By Length of Longest Runway and Region
December 31, 1980

FAA Region	TOTAL	Airports by Length of Longest Runway		
		Under 5,000 Feet	5000-9,999 Feet	10,000 Feet & Over
TOTAL	15,161	13,441	1,454	266
New England	542	457	65	20
Eastern	1,971	1,821	123	27
Great Lakes	3,253	3,013	195	45
Central	1,340	1,261	69	10
Southern[b]	1,851	1,611	223	17
Southwest	2,263	1,988	251	24
Rocky Mountain	1,090	920	159	11
Western	1,164	983	161	20
Northwest	891	807	71	13
Alaska	731	531	122	78
Pacific[c]	65	49	15	1

Source: Federal Aviation Administration.

a Includes seaplane bases, heliports, stolports and military fields having joint civil-military use.

b Includes Puerto Rico and the Virgin Islands.

c Hawaii, American Samoa, Guam, Saipan, and Trust Territory.

HELICOPTER TRANSPORTATION

Use of the helicopter as a civil transportation vehicle continued to grow in 1980, according to the 1980/81 Directory of Helicopter Operators compiled by Aerospace Industries Association. The directory reported that the number of helicopters operated in the United States, Canada and Puerto Rico topped 8,500, an all-time high. Commercial helicopters accounted for roughly 5,600, or about 65 percent of the total.

The number of civil helicopter operators in 1980 approached 2,600, the largest group being corporate/executive operators. Commercial operators totaled 1,065 and there were 348 federal, state and local government operators.

The figures—for both operators and helicopters in operation—are not directly comparable with those of prior years, since computerization of data eliminated prior year duplications.

The directory shows that Canada had, in 1980, 222 operators flying 1,547 helicopters. The latter figure represents 18 percent of the combined U.S./Canadian total.

Among the states, California led in

number of helicopter operators with 271. Texas (195) was second and Florida (153) was third. In terms of numbers of helicopters in service, California again ranked first with 927 and Louisiana placed second with 692. Texas was third with 564.

There were no regularly scheduled helicopter transportation services during 1980 but—after a hiatus dating back to the spring of 1979—New York Helicopter (NYH) was preparing at year-end to launch a new service. NYH was planning to operate some 200 daily flights on weekdays and more than 100 over weekends between New York area airports and a downtown Manhattan heliport. (The service was inaugurated in January 1981).

A new U.S. civil helicopter made its flight debut in 1980. The Boeing Vertol Model 234 Commercial Chinook, a tandem-rotor high-payload transport, made its initial flight in August and certification testing proceeded on schedule. The first six Commercial Chinooks were in production at year-end and initial deliveries were planned for 1981.

Sikorsky Aircraft topped the 100 mark in deliveries of its S-76 twin-turbine helicopter, in production since 1978. By year-end, the company had orders for 432 S-76s.

Bell Helicopter Textron began deliveries of its Model 222 twin-transport. At year-end, Bell was expecting certification and planning to introduce a new four-bladed Model 412, an improved version of the company's Model 212 civil helicopter.

In the field of rotary wing research and development, there were three major flight programs—jointly sponsored by NASA and the military services—involving vehicles with both civil and military potential. Among them was the NASA/Army XV-15 Tilt Rotor Research Aircraft, whose rotors tilt forward after vertical takeoff to become propellers for cruise flight. During 1980, the XV-15 made a series of successful transitions and achieved a top forward speed of 346 miles per hour. Bell completed company testing of the Number One XV-15 and delivered it to NASA's Dryden Flight Research Center for further testing; the Number Two craft was being separately tested at NASA's Ames Research Center.

NASA was also conducting flight tests of two Sikorsky-built S-72 Rotor Systems Research Aircraft in a joint project with the Army. The S-72 was being used as a flying laboratory for test of new rotor, propulsion and other helicopter systems.

In cooperating with all the military services, NASA continued testing Sikorsky's ABC (Advancing Blade Concept) research helicopter. During the year, the craft attained a speed of more than 300 miles per hour and reached a maximum altitude of 24,700 feet, achieving two of the program's primary goals.

Boeing Vertol's Heavy Lift Helicopter research program, earlier terminated by the Army, was reinstituted in 1980 with a NASA contract for development of an advanced transmission.

CIVIL HELICOPTER OPERATORS AND HELICOPTERS OPERATED IN THE UNITED STATES, CANADA AND PUERTO RICO
Selected Years 1965-1980

Year	TOTAL	Commercial	Corporate and Executive	Civil Government Agencies[a]
CIVIL HELICOPTER OPERATORS				
1965	860	508	299	53
1966	933	519	353	61
1967	1,023	522	427	74
1969	1,379	689	596	94
1971	1,424	672	590	162
1972	1,491	758	566	167
1973	1,532	752	599	181
1974	1,536	725	608	203
1975	1,891	779	833	279
1976	2,330	911	1,082	337
1977	2,547	959	1,219	369
1978	3,003	1,126	1,515	362
1980[c]	2,573	1,065	1,160	348
HELICOPTERS OPERATED[b]				
1965	2,053	1,537	401	115
1966	2,318	1,699	475	144
1967	2,438	1,764	487	187
1969	3,433	2,390	770	273
1971	3,874	2,605	802	467
1972	4,185	2,992	745	448
1973	4,601	3,295	780	526
1974	4,819	3,418	778	623
1975	5,222	3,342	1,056	824
1976	6,181	3,702	1,392	1,087
1977	7,160	4,294	1,578	1,288
1978	8,023	4,904	1,891	1,228
1980[c]	8,575	5,581	1,635	1,360

Source: Aerospace Industries Association, "Directory of Helicopter Operators in the United States, Canada and Puerto Rico, 1980."

a Federal, state and local governments.

b Includes helicopters on order.

c Because computerization of Directory data resulted in the elimination of some duplication of operator and helicopter listings, 1980 data are not comparable with those of previous years.

HELIPORTS AND HELISTOPS IN THE UNITED STATES, CANADA AND PUERTO RICO

By Region
Selected Years 1970-1977

Region	1970	1972	1973	1975	1977[a]
TOTAL	2,310	2,326	2,384	3,268	3,433
Elevated Facilities	216	211	241	277	299
New England	93	87	78	143	164
Middle Atlantic	514	571	581	684	795
East North Central	293	281	307	411	397
West North Central	107	109	110	98	107
South Atlantic	192	190	204	352	306
East South Central	47	65	64	107	144
West South Central	205	216	217	338	339
Mountain	157	168	176	241	213
Pacific	593	545	551	789	821
Puerto Rico	24	24	24	30	73
Canada	85	70	72	75	74

Source: Aerospace Industries Association, "Directory of Heliports in the U.S., Canada, Puerto Rico, 1977/78."
NOTE: Totals include proposed facilities.
a Latest available data.

HOSPITAL HELIPORTS IN THE UNITED STATES, CANADA AND PUERTO RICO

By Region
Selected Years 1970-1977

Region	1970	1972	1973	1975	1977[a]
TOTAL	285	354	384	565	699
New England	5	5	5	16	21
Middle Atlantic	29	43	42	55	73
East North Central	74	82	99	126	150
West North Central	18	22	21	22	29
South Atlantic	33	39	50	76	82
East South Central	5	18	18	29	54
West South Central	20	26	26	59	67
Mountain	24	29	32	56	67
Pacific	73	87	87	119	147
Puerto Rico	–	–	–	–	2
Canada	4	3	4	7	7

Source: Aerospace Industries Association, "Directory of Heliports in the U.S., Canada, Puerto Rico, 1977/78."
NOTE: Totals include proposed facilities.
a Latest available data.

CIVIL HELICOPTER FLEET
UNITED STATES, CANADA AND PUERTO RICO
1980

State	OPERATORS				HELICOPTERS			
	TOTAL	Commercial	Corp. and Exec.	Civil Gov't.	TOTAL	Commercial	Corp. and Exec.	Civil Gov't.
Alabama	51	11	29	11	346	19	40	287
Alaska	52	34	14	4	290	261	24	5
Arizona	62	32	24	6	204	135	43	26
Arkansas	16	6	7	3	28	9	14	5
California	271	122	103	46	927	544	175	208
Colorado	52	24	19	9	135	83	29	23
Connecticut	17	7	10	–	29	14	15	–
Delaware	7	–	6	1	8	–	6	2
Dist. of Col.	9	2	–	7	29	2	–	27
Florida	153	61	55	37	489	315	81	93
Georgia	23	7	8	8	66	28	7	31
Hawaii	19	13	5	1	37	28	7	2
Idaho	38	18	14	6	87	58	18	11
Illinois	48	23	15	10	114	72	20	22
Indiana	53	19	22	12	97	41	28	28
Iowa	24	12	8	4	40	22	8	10
Kansas	20	8	8	4	37	16	10	11
Kentucky	56	10	43	3	91	34	49	8
Louisiana	56	22	22	12	692	593	76	23
Maine	8	4	3	1	18	10	4	4
Maryland	16	7	6	3	52	30	6	16
Massachusetts	22	9	11	2	50	32	15	3
Michigan	56	17	28	11	103	43	33	27
Minnesota	30	15	14	1	73	50	19	4
Mississippi	10	2	2	6	20	4	2	14
Missouri	31	15	9	7	74	42	9	23
Montana	24	15	4	5	63	46	4	13
Nebraska	19	8	9	2	35	19	14	2
Nevada	23	10	8	5	56	34	13	9
New Hampshire	12	6	6	–	25	15	10	–
New Jersey	66	23	37	6	145	84	46	15
New Mexico	19	7	10	2	36	18	13	5

(Continued on next page)

CIVIL HELICOPTER FLEET
UNITED STATES, CANADA AND PUERTO RICO (Continued)
1980

State	OPERATORS				HELICOPTERS			
	TOTAL	Commercial	Corp. and Exec.	Civil Gov't.	TOTAL	Commercial	Corp. and Exec.	Civil Gov't.
New York	91	29	48	14	245	133	68	44
North Carolina	27	6	16	5	48	15	18	15
North Dakota	14	10	4	–	30	26	4	–
Ohio	85	30	48	7	153	77	56	20
Oklahoma	33	13	16	4	115	78	18	19
Oregon	87	40	42	5	406	320	52	34
Pennsylvania	114	34	79	1	202	101	93	8
Rhode Island	4	2	1	1	6	3	2	1
South Carolina	26	7	14	5	59	38	15	6
South Dakota	7	3	1	3	8	4	1	3
Tennessee	49	14	25	10	101	38	25	38
Texas	195	71	107	17	564	340	170	54
Utah	25	17	7	1	144	132	11	1
Vermont	6	–	6	–	6	–	6	–
Virginia	39	12	20	7	56	17	22	17
Washington	89	46	35	8	200	128	42	30
West Virginia	54	10	40	4	74	19	46	9
Wisconsin	21	6	12	3	68	52	11	5
Wyoming	14	8	6	–	34	28	6	–
Puerto Rico	5	1	2	2	9	1	2	6
Not Stated	3	2	–	1	4	3	–	1
TOTAL—U.S.	2,351	930	1,088	333	7,028	4,254	1,506	1,268
Canada	222	135	72	15	1,547	1,327	129	91
GRAND TOTAL	2,573	1,065	1,160	348	8,575	5,581	1,635	1,359

Source: Aerospace Industries Association, "Directory of Helicopter Operators in the United States, Canada and Puerto Rico, 1980/81."

CIVIL HELICOPTER DESIGNATION CHART
U.S. MANUFACTURERS

COMPANY	Commercial Model	Number of Places	Useful Load (Lbs.)	Range with Useful Load N. Miles	External Cargo Payload (Lbs.)
Bell Helicopter Textron Fort Worth, TX	47G Series	3	670-1210	212-238	0-1000
	47J Series	4	1090-1204	224-258	—
	AG-5	2	1300	102	—
	204 Series	7-11	1956-4880	123-335	—
	205A-1	15	4542	276	5000
	206 Series	4-5	1315-1630	240-304	1200-1500
	206L Series	7	1894-1931	297-308	2000
	212	15	5672	226	5000
	214 Series	16	5450-6059	219-400	6000-7000
	222	6-10	2975	379	2100
Boeing Vertol Company Philadelphia, PA	107-II	28	7585	240	11,500
	234 Chinook (LR)	47	22,551	620	28,000
	234 Chinook (UT)	3	30,345	280	28,000
Brantley-Hynes Helicopter, Inc. Frederick, OK	B-28	2	670	225	400
	305	5	1200	275	800
The Enstrom Helicopter Corp. Menominee, MI	F-28 Series	3	700-1000	238-272	500-1000
	280L Series	3-4	700-1038	263-270	500-1000
Hiller Aviation Porterville, CA	UH 12E	3	1341	215	1000
	UH 12E4	4	1264	215	1000
	UH 12ET	3	1450	351	1000
	UH 12E4T	4	1450	351	1000
Hughes Helicopters, Inc. Culver City, CA	300 Series	3	698-1004	191-224	1104
	500 Series	4-7	1320-1660	318-330	1500-2000
Robinson Helicopter Co. Torrance, CA	R22	2	504	208	—
United Technologies Corp. Sikorsky Aircraft Div. Stratford, CT	S-58T	14-16	5370	271	5000
	S58JT	14-15	4923	282	5000
	S-62A	13	2967	453	3000
	S-61L(Mark II) Airline	30	7208	305	6500
	S-61 (Mark II) Payloader	2	11,600	305	11,000
	S-61N (Mark II)	26-28	7990	490	6000
	S-76	14	4525	466	4200

Source: Aerospace Industries Association, "Directory of Helicopter Operators in the United States, Canada and Puerto Rico, 1980/81."

REVENUE TON-MILE TRAFFIC CARRIED SCHEDULED HELICOPTER AIRLINES

Calendar Years 1960–1980
(Thousands)

Year	TOTAL TON-MILES	Passenger	U.S. Mail	Express	Freight
1960	1,054	916	91	40	7
1961	963	822	94	40	7
1962	897	780	65	44	6
1963	1,317	1,193	74	44	6
1964	1,668	1,525	92	45	6
1965	1,948	1,794	84	60	10
1966	2,562	2,422	60	70	10
1967	2,960	2,826	61	64	9
1968	2,482	2,367	57	48	8
1969	1,704	1,627	34	37	6
1970	1,167	1,133	5	25	4
1971	917	897	4	13	3
1972	1,020	1,000	5	12	3
1973	1,108	1,094	3	8	3
1974	1,055	1,047	4	2	2
1975	868	860	5	1	2
1976	755	749	3	—	2
1977	465	462	2	—	1
1978	495	493	1	—	1
1979[a]	63	53	—	—	—
1980[a]	—	—	—	—	—

Source: Civil Aeronautics Board, Data Systems Management Division
a. No helicopter carrier operations from April 1979 through 1980

HELICOPTER TRAFFIC
UNITED STATES SCHEDULED AIRLINES
Calendar Years 1960–1980
(Thousands)

Year	Miles Flown	Passengers Carried	Passenger-Miles	Ton-Miles
1960	2,219	430	9,475	1,054
1961	2,157	490	8,604	963
1962	1,518	359	8,192	897
1963	1,462	458	12,510	1,317
1964	1,976	608	16,003	1,668
1965	1,984	718	18,811	1,948
1966	2,241	1,067	25,420	2,562
1967	2,660	1,220	29,670	2,960
1968	2,547	1,042	24,856	2,482
1969	1,909	737	17,074	1,703
1970	1,427	573	11,341	1,167
1971	1,048	551	8,973	917
1972	1,022	587	10,009	1,020
1973	1,085	613	10,936	1,108
1974	1,029	592	10,298	1,055
1975	873	505	8,370	868
1976	709	444	7,490	755
1977	468	268	4,625	466
1978	403	282	4,927	495
1979[a]	58	36	625	63
1980[a]	—	—	—	—

Source: Civil Aeronautics Board, Data Systems Management Division
a No helicopter carrier operations from April 1979 through 1980

RESEARCH AND DEVELOPMENT

Aerospace industry expenditures for industrial research and development, including both government-funded and company-funded R&D, declined slightly in 1980. According to preliminary National Science Foundation data, aerospace expenditures amounted to $8.3 billion, down from $8.5 billion in the previous year.

The aerospace decline was contrary to a national trend in which R&D expenditures of most U.S. industries increased substantially in 1980. Aerospace, which led all industries in 1979 outlays, slipped to second place behind electrical machinery. Expenditures for the latter industry climbed more than 16 percent in 1980 to $8.9 billion. Total industrial R&D outlays for all U.S. manufacturing industries amounted to almost $41 billion, up 13 percent over 1979.

Estimates for 1981 indicate that aerospace R&D expenditures will increase by roughly 10 percent to $9.1 billion. The rate of increase, however, is well below the national average of 15 percent, according to a survey conducted by the Economics Department of McGraw-Hill Publications Company. Adjusted for inflation, national industrial R&D spending will rise

about five percent, a greater gain than in previous years.

The survey stated that all U.S. manufacturing industries anticipate increased R&D expenditures in 1981. Leading the way, with a projected level of $11.6 billion (a 31 percent increase over 1980), is the electrical machinery industry, which will retain its top ranking. Aerospace will again rank second.

The McGraw-Hill survey also covered planned industrial R&D outlays over the period 1981-84 and found that U.S. firms generally intend to commit larger shares of their resources to R&D. From 1981 to 1984, R&D expenditures are projected to climb 41 percent to an all-industry total of $71.1 billion. In terms of 1981-84 rate of change, the largest increases will be by general machinery (77 percent), autos/trucks (41 percent), electrical machinery (39 percent), aerospace (36 percent), instruments (36 percent) and chemicals (33 percent). In terms of projected 1984 expenditures, the five leading industries will rank in the same order as in 1980/81, led by electrical machinery ($16.2 billion) and aerospace ($12.4 billion).

In line with a trend evidenced since 1977, federal outlays for research and development continued to rise in Fiscal Year 1981 and are expected to increase at a higher rate in FY 1982. Estimates for FY 1981 show a total of $33.6 billion, up more than 10 percent over FY 1980's $30.4 billion. The Administration's FY 1982 budget plan contemplates federal R&D outlays of $38.3 billion, which would represent an increase over FY 1981 of 14 percent.

In the areas primarily affecting the aerospace industry, Department of Defense outlays for FY 1981 are estimated at $15.6 billion, up more than 15 percent over the previous year's $13.5 billion. Estimates for FY 1982 show a large DoD spending boost—more than 25 percent—to $19.6 billion.

NASA research and development outlays for FY 1981 are estimated at $5.1 billion, up from $4.7 billion in FY 1980, an increase of less than nine percent which, adjusted for inflation, amounts to zero growth. Projected NASA outlays for FY 1982 ($5.7 billion) represent an increase of 12.2 percent.

R&D outlays for the Department of Energy, at $5 billion in FY 1981, compare with $4.7 billion in FY 1980, a gain of less than seven percent. But in FY 1982 outlays are expected to decline to $4.9 billion, the first annual decline since the establishment of DoE.

In FY 1981, federal outlays for aeronautical research and development will decline across the board. The total is estimated at $2.8 billion, down $123 million from the previous year. Department of Defense funding, at $2.1 billion, is down $74 million. NASA outlays of $526 million are down by $44 million. Aeronautics funding for the Department of Transportation (Federal Aviation Administration) is reduced by $5 million to a total of $87 million.

INDUSTRIAL RESEARCH AND DEVELOPMENT ALL INDUSTRIES AND THE AEROSPACE INDUSTRY

Calendar Years 1960–1981
(Millions of Dollars)

Year	TOTAL	Aerospace Industry		
	All Industries	TOTAL	Federal Government Funds	Company Funds
1960	$ 10,509	$ 3,514	$ 3,150	$ 364
1961	10,908	3,829	3,438	392
1962	11,464	4,042	3,588	454
1963	12,630	4,712	4,261	452
1964	13,512	5,078	4,621	457
1965	14,185	5,148	4,499	649
1966	15,548	5,526	4,724	802
1967	16,385	5,669	4,531	1,138
1968	17,429	5,765	4,533	1,230
1969	18,308	5,882	4,528	1,354
1970	18,067	5,219	4,005	1,213
1971	18,320	4,881	3,864	1,017
1972	19,552	4,950	3,970	978
1973	21,249	5,052	3,899	1,154
1974	22,887	5,278	4,000	1,278
1975	24,187	5,713	4,428	1,285
1976	26,997	6,339	4,921	1,418
1977	29,928	7,104	5,541	1,563
1978[r]	33,365	7,690	5,811	1,879
1979[r]	37,958	8,454	6,157	2,297
1980[E]	42,750	8,291	NA	NA
1981[E]	49,150	9,097	NA	NA

Source: National Science Foundation; McGraw-Hill, "Annual Survey of Business' Plans for Research and Development Expenditures."
NOTE: Totals may not add because of rounding.
r Revised.
E Estimate.

INDUSTRIAL RESEARCH AND DEVELOPMENT IN AEROSPACE

By Type of Research and Fund Source
Calendar Years 1960–1979
(Millions of Dollars)

Year	TOTAL AEROSPACE	Applied Research and Development Funds			Basic Research Funds		
		TOTAL	Federal Government Contracts	Company	TOTAL	Federal Government Contracts	Company
1960	$3,514	$3,452	$3,118	$ 334	$62	$32	$30
1961	3,829	3,789	3,417	372	40	20	20
1962	4,042	3,987	3,558	429	55	30	25
1963	4,712	4,653	4,229	424	59	31	28
1964	5,078	5,010	4,585	424	68	35	33
1965	5,148	5,074	4,457	617	74	42	32
1966	5,526	5,452	4,685	767	74	39	35
1967	5,669	5,596	4,497	1,099	73	34	39
1968	5,765	5,694	4,508	1,185	70	25	45
1969	5,882	5,816	4,500	1,313	65	23	42
1970	5,219	5,156	3,985	1,170	63	20	43
1971	4,881	4,831	3,848	983	50	16	34
1972	4,950	4,887	3,949	937	62	21	41
1973	5,052	4,992	3,871	1,118	58	20	38
1974	5,278	5,221	3,895	1,236	57	18	39
1975	5,713	5,659	4,416	1,243	54	18	36
1976	6,339	6,285	4,899^{E}	1,386^{E}	54	22^{E}	32^{E}
1977	7,104	7,048	5,516^{E}	1,532^{E}	56	25^{E}	31^{E}
1978	7,690	NA	NA	NA	NA	NA	NA
1979	8,454	8,364	NA	NA	90	NA	NA

Source: National Science Foundation.
NOTE: Totals may not add because of rounding.
r Revised.
E Estimate.
NA Not Available.

FEDERAL OUTLAYS FOR CONDUCT OF RESEARCH AND DEVELOPMENT

Fiscal Years 1960–1982
(Millions of Dollars)

Year	TOTAL	DOD	NASA	Energy[a]	Other
1960	$ 7,738	$ 5,654	$ 401	$ 986	$ 697
1961	9,278	6,618	744	1,111	805
1962	10,379	6,812	1,257	1,284	1,026
1963	12,000	6,849	2,552	1,335	1,264
1964	14,694	7,517	4,171	1,505	1,501
1965	14,875	6,728	5,093	1,520	1,534
1966	16,002	6,735	5,933	1,462	1,872
1967	16,842	7,680	5,426	1,467	2,269
1968	16,865	8,148	4,724	1,593	2,400
1969	16,207	7,858	4,251	1,654	2,444
1970	15,632	7,568	3,753	1,616	2,695
1971	15,050	7,541	3,382	1,303	2,824
1972	16,629	8,275	3,422	1,552	3,380
1973	17,407	8,574	3,315	1,623	3,895
1974	18,239	8,956	3,256	1,825	4,202
1975	19,525	9,341	3,266	2,277	4,641
1976	20,233	9,329	3,521	2,225	5,158
1977	22,462	10,176	3,763	3,181	5,342
1978	24,532	10,726	3,833	3,925	6,048
1979	26,578	11,454	4,064	4,413	6,648
1980	30,351	13,451	4,711	4,698	7,492
1981[E]	33,584	15,587	5,118	5,003	7,879
1982[E]	38,271	19,596	5,742	4,858	8,077

Source: "The Budget of the United States Government" (Annually).
NOTE: Totals may not add because of rounding.
a AEC research and development programs transferred to ERDA with 1974 reorganization, to Dept. of Energy in 1977.
E Estimate.

FEDERAL AERONAUTICS RESEARCH AND DEVELOPMENT

Budget Authority
Fiscal Years 1967-1981
(Millions of Dollars)

Year	TOTAL	NASA[a]	DOD[b]	DOT[c]
1967	$1,613	$105	$1,199	$309
1968	1,404	136	1,126	142
1969	1,300	169	1,161	– 30[d]
1970	1,882	199	1,641	42
1971	1,990	210	1,707	73
1972	2,295	236	1,964	95
1973	2,187	313	1,799	75
1974	2,030	278	1,678	74
1975	2,015	314	1,627	74
1976	2,351	325	1,941	85
Tr. Qtr.	584	83	480	22
1977	2,727	378	2,256	93
1978	3,338	437	2,807	94
1979	2,850	519	2,240	91
1980[E]	2,885	570	2,223	92
1981[E]	2,762	526	2,149	87

Source: NASA, "Aeronautics and Space Report of the President" (Annually).
NOTE: FY1982 and revised FY1981 estimates not available at time of publication.
a Research and Development, Construction of Facilities, Research and Program Management.
b Research, Development, Testing and Evaluation of aircraft and related equipment.
c Federal Aviation Administration Research and Development.
d Unobligated balances for SST research and development, rescinded in 1969.
E Estimate.

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION

Fiscal Years 1980 to 1982
(Millions of Dollars)

	1980	1981[E]	1982[E]
TOTAL—APPROPRIATIONS FOR RDT&E	$13,495	$16,653	$21,321
BY APPROPRIATION			
Army	2,846	3,166	3,905
Navy	4,563	5,042	6,083
Air Force	5,001	7,107	9,398
Defense Agencies	1,042	1,296	1,882
Director of Test and Evaluation	43	42	53
BY RESEARCH CATEGORIES			
Research	553	614	723
Exploratory Development	1,712	1,940	2,373
Advanced Development	2,811	2,915	3,627
Engineering Development	4,618	6,388	8,475
Management and Support	1,538	1,714	2,099
Operational Systems Development	2,263	3,081	4,024
RECAP OF BUDGET ACTIVITIES			
Technology Base	2,265	2,555	3,095
Advanced Technology Development	604	600	761
Strategic Programs	2,188	3,525	4,952
Tactical Programs	5,313	6,162	7,548
Intelligence and Communications	1,128	1,550	2,109
Defensewide Mission Support	1,996	2,260	2,855
RECAP OF FYDP PROGRAMS			
Strategic Forces	577	677	782
General Purpose Forces	512	706	859
Intelligence and Communications	1,150	1,657	2,328
Airlift/Sealift	13	27	31
Research and Development (FYDP Program 6)	11,232	13,572	17,297
Central Supply and Maintenance	8	10	21
Training, Medical and Other	1	1	1
Support of Other Nations	2	2	3

Source: Department of Defense Budget (Annually).
E Estimate.

DEPARTMENT OF DEFENSE
OUTLAYS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION

Fiscal Years 1970–1982
(Millions of Dollars)

By Function

Year	TOTAL, All RDT&E Functions	Aircraft	Missiles	Astronautics	Other
1970	$ 7,166	$ 1,239	$ 2,196	$ 753	$ 2,978
1971	7,303	1,699	2,008	519	3,077
1972	7,881	2,066	2,157	468	3,190
1973	8,157	2,036	2,038	512	3,571
1974	8,582	1,893	2,160	561	3,968
1975	8,866	1,698	2,176	515	4,477
1976	8,923	1,603	2,295	581	4,444
Tr. Qtr.	2,206	410	520	129	1,147
1977	9,795	2,176	2,259	537	4,823

By Agency

Year	TOTAL, All RDT&E Functions	Air Force	Navy	Army	Other
1970	$ 7,166	$ 2,937	$ 2,084	$ 1,665	$ 480
1971	7,303	2,809	2,405	1,569	520
1972	7,881	3,205	2,427	1,779	470
1973	8,157	3,362	2,404	1,912	479
1974	8,582	3,240	2,623	2,190	529
1975	8,866	3,308	3,021	1,964	573
1976	8,923	3,338	3,215	1,842	528
Tr. Qtr.	2,203	830	778	437	161
1977	9,795	3,618	3,481	2,069	627
1978	10,508	3,626	3,825	2,342	715
1979	11,152	4,080	3,826	2,409	837
1980	13,127	5,017	4,382	2,707	1,021
1981[E]	15,160	6,012	4,950	2,974	1,224
1982[E]	19,156	8,475	5,493	3,543	1,645

Source: Department of Defense Budget (Annually).
a Data no longer available in this format.
E Estimate.

DEPARTMENT OF DEFENSE
PRIME CONTRACT AWARDS[a]
FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION
Fiscal Years 1976-1980
(Millions of Dollars)

Program Categories	1976	1977	1978	1979	1980
TOTAL—RDT&E	$6,871	$7,893	$8,683	$8,543	$9,470
Research	276	319	323	381	648
Exploratory Development	593	673	780	726	868
Other Development	5,364	6,247	6,895	6,327	6,920
Management & Support	638	654	685	1,109	1,034
Aircraft—TOTAL	$1,378	$1,649	$1,640	$1,315	$1,171
Research	2	3	2	9	3
Exploratory Development	18	31	43	25	39
Other Development	1,345	1,606	1,591	1,268	1,126
Management & Support	13	9	4	13	3
Missile and Space Systems—TOTAL	2,305	2,302	2,721	3,064	3,363
Research	34	16	20	13	36
Exploratory Development	107	133	178	137	173
Other Development	1,991	2,023	2,415	2,530	2,800
Management & Support	173	130	108	384	354
Electronics & Communications Equipment—TOTAL	1,491	1,789	1,765	1,893	2,417
Research	33	35	37	56	67
Exploratory Development	144	165	156	226	260
Other Development	1,253	1,500	1,476	1,499	1,977
Management & Support	61	89	96	112	113
All Other—TOTAL[b]	1,697	2,153	2,557	2,271	2,519
Research	207	265	264	304	542
Exploratory Developn ent	324	344	403	338	396
Other Development	775	1,118	1,413	1,029	1,017
Management & Support	391	426	477	600	564

Source: Department of Defense, "Prime Contract Awards by Service Category and Federal Supply Classification" (Annually).

a Effective FY 1980, data include DOD contract awards for civil functions; data for prior years limited to military prime contract awards.

b "All Other" includes ships, tank-automotive, weapons, ammunition and services.

MILITARY AIRCRAFT PROGRAMS
RESEARCH, DEVELOPMENT, TEST AND EVALUATION[a]

By Agency, Type and Model
Fiscal Years 1980, 1981 and 1982
(Millions of Dollars)

Agency, Type and Model	1980	1981[E]	1982[E]
AIR FORCE			
A-10	$ 17.8	$ 23.6	$ 14.4
*B-52 Companion Trainer	—	12.4	2.4
B-52G Cruise Missile Aircraft Modification	3.9	9.0	7.2
B-52G/H Avionics Modernization	55.0	45.0	21.9
C-5 Wing Modification	13.0	11.0	15.9
*CMCA	15.0	—	—
*C-X	—	34.6	252.0
E-3A (AWACS)	41.2	63.0	53.8
EF-111A Modification	7.2	5.6	14.5
F-15 Eagle	2.5	11.1	57.8
F-16 Multimission Fighter	25.6	42.2	43.0
KC-135 Re-engining	10.0	15.0	24.9
*LRCA	—	265.0	2,456.0
NAVY			
A-6E Intruder	$ 3.2	$ —	$ —
AV-8B	180.3	240.7	230.7
CH-53E Super Stallion	9.9	14.7	11.3
E-2C Hawkeye	11.1	19.3	19.2
F-14A Tomcat	—	10.2	12.1
F/A-18 Hornet	310.3	174.1	175.4
H-46 Modification	—	4.4	—
P-3C Orion	28.7	33.1	19.5
SH-60B Seahawk LAMPS	178.7	102.3	74.8
ARMY			
AH-1S Cobra/Tow	$ 0.9	$ 8.5	$ 20.1
UH-60A Black Hawk	2.3	5.0	4.2
CH-47 Modernization	22.5	0.6	—
AH-64 Attack Helicopter	176.0	172.9	100.0

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually)
a Total Obligational Authority.
E Estimate.
* Programs in R&D only.

MISSILE PROGRAMS
RESEARCH, DEVELOPMENT, TEST AND EVALUATION[a]

By Agency, Type and Model
Fiscal Years 1980, 1981 and 1982
(Millions of Dollars)

Agency, Type and Model	1980	1981[E]	1982[E]
AIR FORCE			
ALCM	$ 90.6	$107.3	$ 70.6
*AMRAAM	27.0	24.2	143.2
GLCM	59.5	107.8	91.6
Maverick	50.9	36.3	10.9
Minuteman II/III	35.3	53.3	33.6
*M-X	670.0	1,491.0	2,408.7
Sparrow	0.7	3.1	—
Target Drones[b]	41.8	58.1	70.3
NAVY			
Harm[b]	$ 65.6	$81.3	$114.3
Harpoon	—	—	38.6
Maverick	1.0	3.0	—
*MRASM[b]	22.0	22.8	69.3
Phoenix	38.0	37.3	30.8
Sidewinder[b]	11.3	1.8	—
Standard MR (SM-1)	21.9	16.0	15.9
Standard MR (SM-2)	30.3	22.0	24.6
*SM-2 Improvement	77.2	63.4	52.0
Tomahawk	104.8	144.6	154.0
Trident I	36.8	26.3	42.1
*Trident II	25.6	97.6	242.9
ARMY			
Chaparral	$ 6.1	$ 23.2	$ 20.1
Copperhead	9.0	6.1	3.4
Hawk[c]	9.9	7.4	40.2
Hellfire	61.0	45.0	24.8
MLRS	70.2	69.6	42.1
Patriot	128.7	52.0	58.6
Pershing II	145.8	147.4	154.1
Roland	11.3	13.2	4.0
Stinger[c]	18.8	5.9	16.3
TOW[c]	26.2	21.0	6.7

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually).
E Estimate.
a Total Obligational Authority.
b Includes Navy and Air Force.
c Includes Army and Marine Corps.
* Programs in R&D only.

FOREIGN TRADE

In 1980, the U.S. aerospace industry recorded its highest-ever levels of exports and international trade balance. Aerospace thus contributed substantially to the nation's performance in foreign trade by offsetting to a considerable degree the adverse impacts of lagging U.S. trade in a number of other categories. Although the U.S. experienced an overall international trade deficit of $23.4 billion, the amount of the deficit was some $4 billion lower than in the previous year and more than $8 billion below the all-time record deficit of 1978.

Aerospace exports amounted to $15.5 billion, almost $4 billion more than the previous peak—$11.7 billion in 1979. The aerospace trade balance for 1980, the best among U.S. manufacturing industries, was $12 billion, up from $10.1 billion in 1979.

The trade balance was achieved despite a sharp increase in aerospace imports that reflected strong and growing competition from foreign manufacturers, particularly in certain civil aircraft, engines, and parts categories. U.S. imports totaled $3.6 billion, but the total figure cannot be directly compared with previous years because of changes in tariff schedules and reporting categories resulting from implementation of the

multilateral Agreement on Trade in Civil Aircraft.

However, comparison is valid in the civil aircraft category, where imports neared $1 billion and almost doubled the previous year's level. A large part of the increase was due to further penetration by foreign manufacturers of the U.S. market for commuter-type aircraft; imports in this area have mounted steadily over the past five years, from $41 million in 1976 to almost $400 million in 1980.

The import value of large civil aircraft (over 33,000 pounds) increased from $200 million in 1979 to more than $285 million in 1980. There were also significant increases in imports of civil turbine engines, small multiengine aircraft, and helicopters.

In terms of dollar value, civil aerospace exports constituted more than 85 percent of the 1980 total; they were valued at $13.2 billion, compared with $9.8 billion in 1979. The 1980 figure was composed of $8.3 billion for complete aircraft (up $2.1 billion); $4.4 billion for parts, accessories and equipment (up $1.2 billion); and $556 million for aircraft engines (up $181 million).

As in previous years, sales of commercial transport aircraft represented the greatest dollar value among aerospace exports. Export sales of transports totaled $6.7 billion, up from $5 billion in the previous year. Shipments of general aviation aircraft to foreign buyers increased from $650 million in 1979 to $739 million in 1980, although the number of aircraft actually decreased 18 percent. Civil helicopter sales abroad amounted to $299 million, up $92 million.

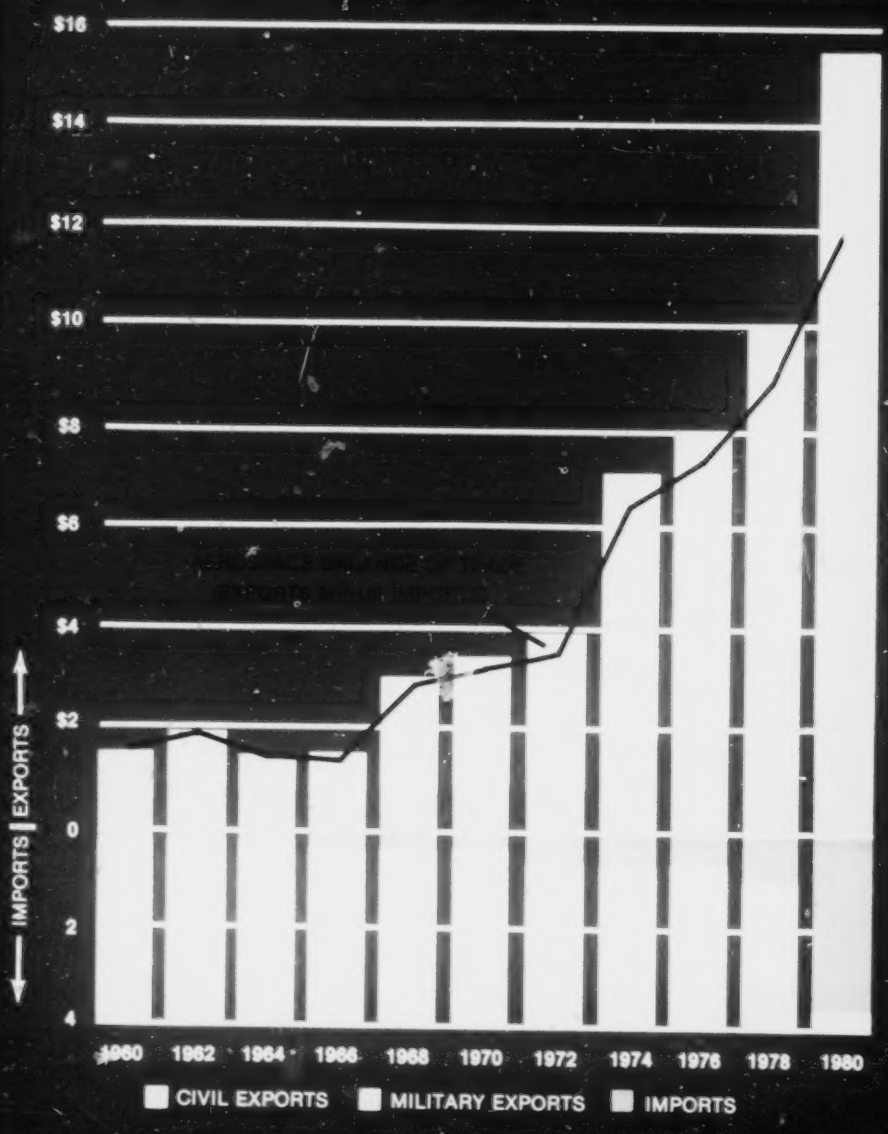
Military exports increased moderately, from approximately $2 billion in 1979 to $2.3 billion in 1980. Shipments of complete aircraft accounted for the largest portion of the total—$949 million, an increase of $111 million. There was a slight increase in exports of parts, accessories and equipment for aircraft and engines, up $39 million to a total of $506 million. Shipments of military aircraft engines were valued at $63 million, a figure which roughly matched the levels of recent years.

The large backlog of orders for U.S. commercial transport aircraft indicate that aerospace exports will remain fairly high, although some declines are expected to occur in 1981-82. For later years, projections are clouded by a number of uncertainties, particularly the extent to which increasing foreign competition will reduce the U.S. share of the world market for commercial transports.

A major factor determining the success of the U.S. in sustaining its market share will be the level of loan and guarantee authority of the U.S. Export-Import Bank, whose activities contribute to American competitiveness in financing export sales of commercial transports. Also affecting U.S. share of the world market will be the government's future position on foreign trade policies and practices, which in the past have constrained overseas sales efforts.

AEROSPACE EXPORTS, IMPORTS, AND TRADE BALANCE

(Billions of Current Dollars)



TOTAL AND AEROSPACE BALANCE OF TRADE

Calendar Years 1960–1980
(Millions of Dollars)

Year	TOTAL U.S. Trade Balance[1]	Aerospace Trade Balance	Aerospace Exports	Aerospace Imports	Aerospace Trade Balance as Percent of U.S. Total
1960	$ 5,369	$ 1,665	$ 1,726	$ 61	31.0%
1961	6,096	1,501	1,653	152	24.6
1962	4,180	1,795	1,923	128	42.9
1963	6,061	1,532	1,627	95	25.3
1964	7,555	1,518	1,608	90	20.1
1965	5,875	1,459	1,618	159	24.8
1966	4,524	1,370	1,673	303	30.3
1967	4,409	1,961	2,248	287	44.5
1968	1,133	2,661	2,994	333	234.9
1969	1,599	2,831	3,138	307	177.0
1970	2,834	3,097	3,405	308	109.3
1971	– 2,024[2]	3,830	4,203	373	[3]
1972	– 6,351	3,230	3,795	565	[3]
1973	1,222	4,360	5,142	782	356.8
1974	– 2,996	6,350	7,095	745	[3]
1975	9,630	7,045	7,792	747	73.2
1976	– 7,765	7,267	7,843	576	[3]
1977	– 28,970	6,850	7,581	731	[3]
1978	– 31,786	9,058	10,001	943	[3]
1979	– 27,260	10,123	11,747	1,624	[3]
1980	– 23,351	11,952	15,506	3,554	[3]

[1] Source: U.S. Department of Commerce, Bureau of the Census, Report FT 900, Monthly, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly), "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT 246 (Monthly).

[2] U.S. Balance of Trade in the GATT Format (Balance on Goods), Including Department of Defense Shipments of Military Equipment and Government Grant Aid Shipments (Data Basis).

[3] Percentage not meaningful because of trade deficit.

[4] Not applicable.

[5] Revised.

U.S. IMPORTS OF AEROSPACE PRODUCTS

Calendar Years 1976–1980
(Millions of Dollars)

	1976	1977	1978	1979	1980
TOTAL	$576.1	$731.2	$943.1	$1,624.3	$3,553.6
Aircraft—TOTAL	155.5	310.2	291.8	512:1	975.1
Civil Aircraft	90.0	258.0	284.5	508.6	969.1
Helicopters	4.5	18.1	28.0	21.6	53.9
Single-Engine	26.3	27.8	0.5	*a*	0.3
Multi-Engine Under 4400 lbs.			2.8	0.4	1.2
Multi-Engine 4400-10,000 lbs.			42.1	37.2	95.2
Multi-Engine 10,000-33,000 lbs.	40.8	80.7	101.4	222.8	399.1
Multi-Engine Over 33,000 lbs.	7.3	100.1	58.1	199.8	285.5
Used or Rebuilt	10.6	31.3	51.6	26.8	133.9
Military Aircraft	64.3	50.2	4.9	1.5	4.0
Gliders	1.1	1.8	2.1	1.6	1.5
Civil	NA	NA	NA	NA	1.5
Military	NA	NA	NA	NA	—
Balloons & Airships	0.1	0.2	0.3	0.4	0.5
Civil	NA	NA	NA	NA	0.3
Military	NA	NA	NA	NA	0.2
Aircraft Engines & Parts—TOTAL	144.9	131.4	283.0	547.0	1,097.4
Piston, Civil	1.0	1.7	1.6	4.0	11.0
Pist. Engs. & Parts, Mil.					1.1
Piston Engine Parts, Civil					8.3
Turbine, Civil	143.9	129.7	281.4	324.2	720.3
Turbine, Military					27.5
Turbine Engine Parts, Civil	NA	NA	NA	218.8	295.1
Turbine Engine Parts, Military	NA	NA	NA		34.1
Other—TOTAL	275.7	289.6	368.3	565.2	1,481.1
Aircraft Parts, Civil	NA	NA	NA	NA	198.5
Spacecraft & Other Parts, Civil	275.6	289.1	368.2	564.5	679.1
Aircraft Parts, Military					121.4
Other Parts, Military					136.8
Aircraft, Engs., & Parts Previously Exported from U.S.	NA	NA	NA	NA	345.2
Other	0.1	0.5	0.1	0.7	0.1

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT246 (Annually).

Note: Import classifications have been revised as of 1980 data, with the total number of categories increased, and most former categories divided into military and civil items. Also effective 1980, import data include two new commodity groupings: civil aircraft parts, and aerospace products previously exported from the U.S. Excluded from aerospace trade data as of 1980 are "Kites & Parts Thereof"; for comparability of annual data, this category has been deducted from totals for previous years.

a Less than $50,000.

NA Not available.

EXPORTS OF U.S. AEROSPACE PRODUCTS

Calendar Years 1976–1980
(Millions of Dollars)

	1976	1977	1978	1979	1980
TOTAL	$7,843	$7,581	$10,001	$11,747	$15,506
TOTAL CIVIL	5,677	5,049	6,018	9,772	13,239
Complete Aircraft—TOTAL	3,211	2,747	3,625	6,177	8,256
Transports	2,468	1,936	2,558	4,998	6,727
General Aviation[a]	362	389	496	650	739
Helicopters	113	105	156	207	299
Other, Including Used	268	317	415	322	491
Aircraft Engines—TOTAL	254	233	277	375	556
Jet & Gas Turbines	213	196	231	323	514
Piston	41	37	46	52	42
Aircraft & Eng. Parts Incl. Spares—TOTAL	2,212	2,069	2,116	3,220	4,427
Aircraft Parts & Accessories	1,697	1,586	1,472	2,412	3,288
Aircraft Engine Parts	515	483	644	808	1,139
TOTAL MILITARY	2,166	2,532	3,983	1,975	2,267
Complete Aircraft—TOTAL[b]	967	1,186	2,243	838	949
Fighters & Fighter Bombers	513	686	1,707	494	449
Transports	151	317	232	162	231
Helicopters	102	84	82	61	88
Other, Including Used	201	99	222	121	181
Aircraft Engines—TOTAL[r]	66	71	61	67	63
Jet & Gas Turbines	58	64	59	61	58
Piston	8	7	2	6	5
Aircraft & Eng. Parts Incl. Spares—TOTAL[r]	638	826	1,044	467	506
Aircraft Parts & Accessories	511	685	912	326	377
Aircraft Engine Parts	127	141	132	141	129
Guided Missiles, Rockets, & Parts—TOTAL[r]	495	449	635	603	749
Guided Missiles & Rockets	93	168	335	292	327
Missile & Rocket Parts	386	270	273	279	393
Missile & Rocket Engines	5	5	3	7	13
Missile & Rocket Engine Parts	11	6	24	25	16

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT410 (Monthly).
a All fixed-wing aircraft under 33,000 pounds.
b Includes aircraft exported under Military Assistance Programs and Foreign Military Sales.
r Revised.

EXPORT—IMPORT BANK
GROSS AUTHORIZATIONS OF CREDITS AND GUARANTEES
Calendar Years 1968-1980
(Millions of Dollars)

Year	TOTAL Credits[a]	Credits in Support of Commercial Aircraft Exports			
		TOTAL	Percent of TOTAL Credits	Jets	Other
1968	$ 2,526	$ 336.8	13.3%	$ 336.8	$ —
1969	1,296	204.7	15.8	197.5	7.2
1970	2,209	636.2	28.8	598.2	38.0
1971	2,362	490.4	20.8	484.2	6.2
1972	3,285	479.6	14.6	475.4	4.2
1973	4,053	722.4	17.8	689.7	32.7
1974	4,905	946.2	19.3	894.6	51.6
1975	3,812	732.3	19.3	691.2	41.1
1976	2,285	421.9	18.4	398.4	23.5
Tr. Qtr.	282	98.3	34.7	93.8	4.5
1977	747	139.0	18.6	137.6	1.4
1978	2,927	195.2	6.7	189.5	5.7
1979	3,825	1,428.7	37.4	1,399.4	29.3
1980	4,087	1,710.1	41.8	1,692.6	17.5

Year	TOTAL Guarantees[b]	Guarantees in Support of Commercial Aircraft Exports			
		TOTAL	Percent of TOTAL Guarantees	Jets	Other
1968	$ 290	$ 63.6	21.9%	$ 50.0	$13.6
1969	397	113.4	28.6	111.2	2.2
1970	612	100.2	16.4	79.2	21.0
1971	1,420	397.3	28.0	363.6	33.7
1972	1,743	202.7	11.6	175.9	26.8
1973	1,988	243.3	12.2	189.6	53.7
1974	1,594	157.7	9.9	133.0	24.7
1975	1,574	96.7	6.1	64.0	32.7
1976	1,661	107.2	6.4	87.2	20.0
Tr. Qtr.	272	62.6	23.2	58.7	3.9
1977	1,021	319.6	31.3	294.0	25.6
1978	589	97.6	16.6	77.2	20.4
1979	908	261.9	28.8	239.3	22.6
1980	2,510	1,131.9	45.1	1,088.1	43.8

Source: Export-Import Bank of the United Sates

a "Credit" is a commitment of direct financing by the Export-Import Bank.

b "Guarantee" by the Export-Import Bank of principal and interest on a loan made by another institution such as a commercial bank.

EXPORTS OF CIVIL AIRCRAFT

Calendar Years 1976-1980

	1976	1977	1978	1979	1980
TOTAL NUMBER OF AIRCRAFT	4,283	4,368	4,399	5,115	4,434
Helicopters, Under 2200 lbs.	201	233	243	294	335
Helicopters, Over 2200 lbs.	114	88	125	165	190
Single-Engine Aircraft	2,374	2,664	2,640	2,821	2,172
Multi-Engine Aircraft, Under 4400 lbs.	228	273	455	645	546
Multi-Engine Aircraft, 4400-10,000 lbs.	612	525	339	360	432
Multi-Engine Aircraft, 10,000-33,000 lbs.	4	7	37	52	28
Passenger Aircraft, Over 33,000 lbs.	158	101	99	172	215
Cargo Aircraft, Over 33,000 lbs.			3	13	8
Other Aircraft, Over 33,000 lbs.			9	15	14
Other Aircraft, Including Balloons, Gliders & Kites	NA	NA	NA	NA	NA
Used or Rebuilt Aircraft	592	477	449	578	494
TOTAL VALUE (Millions of Dollars)	$3,211	$2,747	$3,625	$6,177	$8,256
Helicopters, Under 2200 lbs.	28	38	42	61	82
Helicopters, Over 2200 lbs.	85	68	114	146	217
Single-Engine Aircraft	74	93	103	124	114
Multi-Engine Aircraft, Under 4400 lbs.	17	27	62	94	88
Multi-Engine Aircraft, 4400-10,000 lbs.	269	262	240	306	454
Multi-Engine Aircraft, 10,000-33,000 lbs.	2	6	91	126	83
Passenger Aircraft, Over 33,000 lbs.	2,468	1,936	2,111	4,128	5,511
Cargo Aircraft, Over 33,000 lbs.			142	322	480
Other Aircraft, Over 33,000 lbs.			305	548	736
Other Aircraft, Including Balloons, Gliders & Kites	4	4	27	11	5
Used or Rebuilt Aircraft	264	313	388	311	486

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly).
NOTE: Effective 1978, the export schedule was revised, such that data prior to 1978 may not be strictly comparable to data for subsequent years.
NA Not available.

EXPORTS OF MILITARY AIRCRAFT

Calendar Years 1976–1980

	1976	1977	1978	1979	1980
TOTAL NUMBER OF AIRCRAFT[a]	751	721	589	332	462
Fighters & Fighter Bombers	331	244	286	133	90
Transports	32	53	25	17	23
Helicopters	139	95	108	65	89
New Aircraft, NEC	191	288	110	91	220
Used or Rebuilt Aircraft	58	41	60	26	40
Airships, Balloons, Gliders, etc.	—	—	NA	NA	NA
TOTAL VALUE (Millions of Dollars)[a]	$ 967	$1,186	$2,243	$ 838	$949
Fighters & Fighter Bombers	513	686	1,707	494	449
Transports	151	317	232	162	231
Helicopters	102	84	82	61	88
New Aircraft, NEC	145	20	187	96	148
Used or Rebuilt Aircraft	56	79	11	5	2
Airships, Balloons, Gliders, etc.	—	—	24	20	31

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly)
NOTE: Effective 1978, the export schedule was revised, such that data prior to 1978 may not be strictly comparable to data for subsequent years.
NEC Not elsewhere classified
NA Not available
a Includes aircraft exported under Military Assistance Programs and Foreign Military Sales.

EXPORTS OF USED OR REBUILT AIRCRAFT

Calendar Years 1960–1980
(Millions of Dollars)

Year	TOTAL		Civil		Military	
	Number	Value	Number	Value	Number	Value
1960	634	$ 26.2	564	$ 25.7	70	$ 0.5
1961	618	35.1	494	33.9	124	1.2
1962	511	37.5	382	36.6	129	0.9
1963	423	16.6	356	16.4	67	0.2
1964	489	30.7	288	27.9	201	2.8
1965	474	39.7	407	39.0	67	0.7
1966	397	45.7	364	30.7	33	15.0
1967	391	85.5	362	60.2	29	25.3
1968	304	75.5	290	68.7	14	6.8
1969	382	137.7	379	137.7	3	[a]
1970	361	106.1	358	104.0	3	2.1
1971	419	205.3	413	205.2	6	0.1
1972	471	301.4	450	299.0	21	2.4
1973	621	358.5	597	357.5	24	1.0
1974	709	301.1	690	299.3	19	1.8
1975	597	391.3	581	387.0	16	4.3
1976	650	319.5	592	263.9	58	55.6
1977	518	392.1	477	313.1	41	79.0
1978	509	399.6	449	388.5	60	11.1
1979	604	315.5	578	310.7	26	4.8
1980	534	488.2	494	486.4	40	1.8

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly).
[a] Less than $0.05 million.

EXPORTS OF NEW AND USED CIVIL AIRCRAFT ENGINES

Calendar Years 1960–1980
(Millions of Dollars)

Year	TOTAL		Jet and Gas Turbine		Internal Combustion	
	Number	Value	Number	Value	Number	Value
1960	3,725	$ 70.7	480	$ 47.5	3,245	$ 23.2
1961	3,640	75.3	364	53.6	3,276	21.7
1962	3,690	63.0	341	44.8	3,349	18.2
1963	3,143	45.1	253	25.7	2,890	19.4
1964	4,062	46.7	247	25.0	3,815	21.7
1965	3,330	56.2	372	38.8	2,958	17.4
1966	4,006	77.0	564	49.3	3,442	27.7
1967	4,236	101.2	756	69.6	3,480	31.6
1968	3,279	115.6	866	92.4	2,413	23.2
1969	4,178	102.4	759	82.0	3,419	20.4
1970	3,790	117.6	634	98.4	3,156	19.2
1971	3,530	148.5	707	128.6	2,823	19.9
1972	3,823	184.3	592	158.6	3,231	25.7
1973	5,017	175.7	641	144.8	4,376	30.9
1974	4,924	228.8	801	195.0	4,123	33.8
1975	4,678	231.0	876	185.9	3,802	45.1
1976	4,243	253.7	745	212.8	3,498	40.9
1977	4,199	233.1	667	195.9	3,532	37.2
1978	4,719	277.0	988	230.6	3,731	46.4
1979	4,917	375.4	996	323.2	3,921	52.2
1980	4,606	555.8	1,393	513.7	3,213	42.1

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly).

EXPORTS OF CIVIL HELICOPTERS

Calendar Years 1976–1980

	1976	1977	1978	1979	1980
TOTAL NUMBER EXPORTED	315	321	368	459	525
Canada & Greenland	50	66	57	85	91
Latin America & Caribbean	65	78	78	89	143
Europe	63	62	86	103	118
Middle East	24	13	10	11	21
Asia	57	43	99	80	57
Oceania	41	43	31	66	72
Africa	13	13	7	25	23
Country Not Stated	2	3	—	—	—
TOTAL VALUE (Millions of Dollars)	$113.4	$105.5	$155.7	$206.8	$298.7
Canada & Greenland	10.6	15.9	17.1	29.4	42.9
Latin America & Caribbean	27.2	26.9	29.7	42.4	78.4
Europe	35.8	34.3	50.5	51.6	79.4
Middle East	8.4	4.5	6.2	11.4	24.9
Asia	22.1	15.7	44.4	45.6	51.3
Oceania	7.3	5.8	5.4	21.1	16.3
Africa	2.0	2.4	2.4	5.3	5.5
Country Not Stated	—	—	—	—	—

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly)

EXPORTS OF GENERAL AVIATION AIRCRAFT[a]

Calendar Years 1976–1980

	1976	1977	1978	1979	1980
TOTAL NUMBER EXPORTED . . .	3,218	3,469	3,471	3,878	3,178
Canada & Greenland	748	702	461	478	414
Latin America & Caribbean . . .	1,148	1,336	1,195	1,557	1,452
Europe	580	592	882	988	760
Middle East	58	17	17	38	19
Asia	111	70	84	120	55
Oceania	383	561	666	537	253
Africa	183	179	166	160	225
Country Not Stated	7	12	—	—	—
TOTAL VALUE (Millions of Dollars)	$362.1	$388.4	$495.6	$650.5	$739.5
Canada & Greenland	38.7	39.4	41.2	55.7	49.9
Latin America & Caribbean . . .	107.1	135.6	155.0	221.1	239.5
Europe	103.6	115.3	178.2	219.3	235.0
Middle East	43.9	26.0	14.0	27.4	65.1
Asia	15.1	8.6	12.7	31.5	36.9
Oceania	19.4	31.1	53.0	60.7	52.6
Africa	34.2	32.2	41.5	34.8	60.5
Country Not Stated	0.1	0.2	—	—	—

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT410 (Monthly).
a Fixed-wing aircraft under 33,000 pounds.

EXPORTS OF COMMERCIAL TRANSPORT AIRCRAFT

33,000 Pounds and Over Airframe Weight
Calendar Years 1976–1980

	1976	1977	1978	1979	1980
TOTAL NUMBER EXPORTED	158	101	111	200	237
Canada	1	—	4	20	22
Latin America & Caribbean	15	7	14	19	31
Europe	49	32	36	68	109
Middle East	31	20	17	17	9
Asia	20	22	24	60	53
Oceania	4	4	6	6	7
Africa	38	16	10	10	6
TOTAL VALUE (Millions of Dollars)	$2,468	$1,936	$2,558	$4,998	$6,727
Canada	6	—	132	373	299
Latin America & Caribbean	138	59	187	423	640
Europe	700	571	906	1,601	2,670
Middle East	504	467	541	582	236
Asia	549	468	478	1,722	2,467
Oceania	82	155	118	149	179
Africa	489	216	196	148	236

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country" Report FT 410 (Monthly)

EMPLOYMENT

In 1980, aerospace industry employment reached an 11-year high and further gains are projected for 1981 and 1982.

At year-end 1980, the industry's labor force numbered 1,218,000 and average employment for the year was 1,190,000. The gain marked continuance of an upward trend in evidence since 1978, due for the most part to heightened activity in commercial transport production. However, the 1980 rate of gain in average employment—6.7 percent—was sharply lower than in the previous two years when relative annual increases of about nine and 14 percent were recorded.

In terms of numbers of employees, the largest gain was in aircraft manufacturing. The labor force engaged in production of aircraft, engines, parts and related equipment increased by 44,000 to a 1980 average of 655,000. Employment in missile and space activities increased to 112,000, compared with 102,000 in 1979. There was a slight increase in the communications equipment category, where employment rose from 143,000 to 146,000.

Industry-wide, the number of pro-

duction workers increased 6.6 percent, from 563,000 in 1979 to 600,000—roughly half the industry's total labor force—in 1980. As in previous years, most production workers—357,000 or almost 60 percent—were engaged in the manufacture of aircraft, engines, and parts. Average hourly earnings for these aircraft production workers amounted to $9.27, up more than 12 percent from the previous year's $8.26. Average weekly earnings increased somewhat less (almost 11 percent), from $351 to $389.

The number of scientists and engineers working on aerospace research and development programs increased once again, as it has in every year since 1976, but the increase was of lesser order than in recent years. In 1980, the aerospace scientific/engineering force numbered 88,200, up from 86,500 in 1979. Although the 1980 figure was the highest in a decade, it remained well below the 1968 peak of more than 101,000.

Aerospace R&D-engaged scientists and engineers represented 19.5 percent of all U.S. scientific/engineering personnel in R&D work. The 1980 figure compares with more than 20 percent in the two prior years and with the all-time peak of 30 percent in 1964.

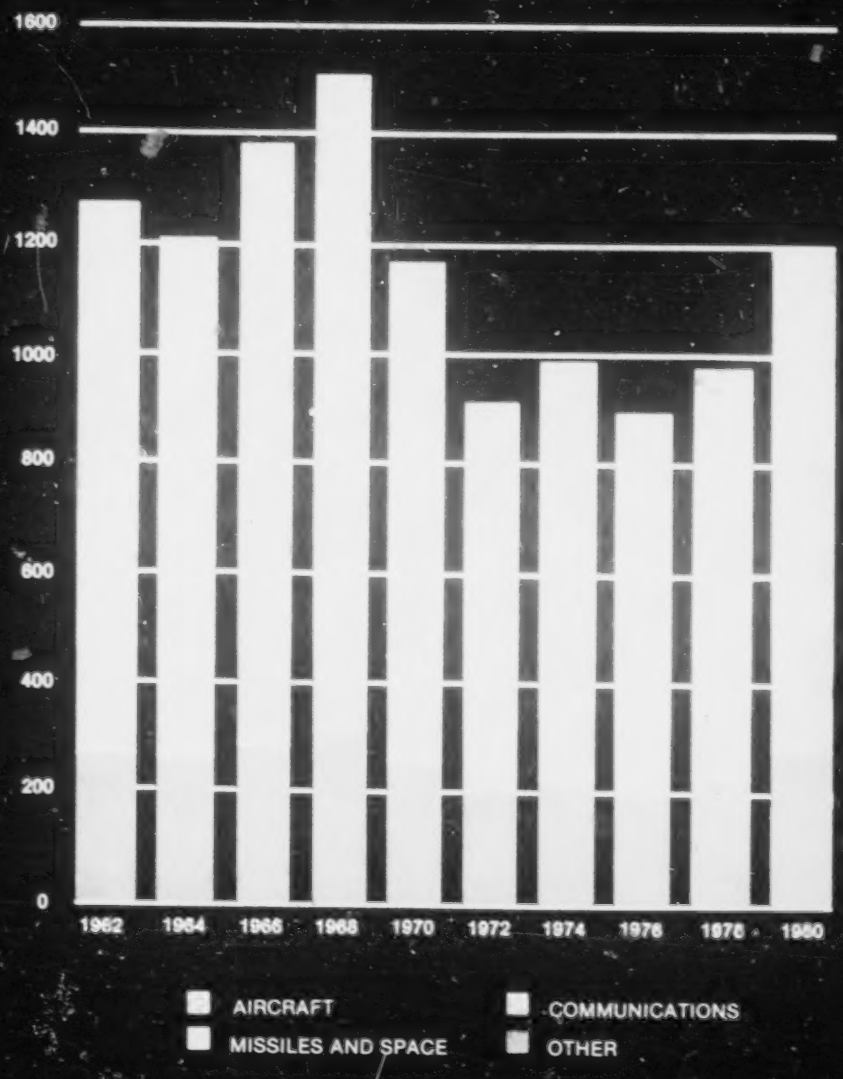
The outlook for immediate future years is for continuing aerospace employment gains, but more modest growth rates. A survey conducted by Aerospace Industries Association projected a labor force of 1,234,000 by the end of 1981 and 1,275,000 by year-end 1982. For 1981, the number of production workers was not expected to change, while all other labor categories will show only slight gains—2.6 to 2.7 percent. In 1982, production employment should increase by 1.6 percent and gains in other categories should run on the order of five percent.

Among other survey findings:

- Year-end 1981 employment in the aircraft manufacturing category will dip slightly below the 1980 level, then climb to more than 700,000 by the end of 1982. However, the number employed by prime manufacturers of commercial transport aircraft is expected to drop in both years—from 98,500 at year-end 1980 to 91,900 in 1981 and 91,300 in 1982.
- The moderate growth in missiles/space employment experienced in recent years is expected to continue in 1981/82, with increases of 1.7 and 3.8 percent.
- Employment among helicopter manufacturers, which stood at 29,800 at the end of 1980, will drop slightly in 1981—to 29,000—but increase to 30,800 by year-end 1982.
- The geographical pattern of aerospace employment is not expected to change in 1981/82. With more than 40 percent of the total, the Pacific region leads all other areas of the country by a wide margin. New England (14.6 percent) ranks second, followed by the West North Central (9.4 percent) and Middle Atlantic (9.2 percent) regions.

AEROSPACE EMPLOYMENT BY PRODUCT GROUP

(Thousands of Employees)



AEROSPACE EMPLOYMENT*

Calendar Years 1966–1980
(Thousands of Employees)

Year	TOTAL	Aircraft	Missiles & Space	Communi-cations Equipment	Other
TOTAL EMPLOYMENT					
1966	1 375	753	159	166	297
1967	1 484	834	157	179	314
1968	1 502	852	150	184	316
1969	1 402	804	124	179	295
1970	1 166	669	98	152	247
1971	951	531	86	129	203
1972	912	495	93	113	211
1973	954	525	93	116	222
1974	962	539	94	121	208
1975	941	514	93	116	218
1976	898	487	86	116	208
1977	893	482	83	121	207
1978	977	527	93	129	228
1979	1 115	611	102	143	259
1980	1 140	656	112	146	277
PRODUCTION WORKERS					
1966	731	446	65	73	157
1967	804	502	68	78	156
1968	807	509	62	80	156
1969	746	468	41	66	171
1970	604	369	31	77	127
1971	480	265	26	86	103
1972	455	266	26	57	106
1973	482	284	29	57	112
1974	494	292	29	59	114
1975	461	271	29	54	107
1976	433	251	26	54	100
1977	429	247	26	56	100
1978	476	275	29	61	111
1979	563	332	33	67	131
1980	600	357	35	69	139

LABOR TURNOVER RATES IN THE AEROSPACE INDUSTRY

Calendar Years 1966–1980
(Rates per 100 Employees per Year)

Year	Complete Missiles and Spacecraft	Aircraft			
		TOTAL	Airframes	Engines & Engine Parts	Other Parts & Equipment
ACCESSIONS					
1966	44.1	48.6	47.3	43.2	61.0
1967	43.5	37.4	36.6	32.5	46.6
1968	40.7	28.1	27.1	22.9	39.8
1969	27.4	23.4	20.8	24.6	31.5
1970	19.3	16.1	13.9	15.1	26.2
1971	21.6	20.4	21.6	13.2	27.6
1972	20.4	24.0	21.6	21.6	37.2
1973	20.4	26.4	22.8	24.0	43.2
1974	22.8	25.2	24.0	18.0	39.6
1975	15.6	16.8	18.0	10.8	20.4
1976	14.4	18.0	16.8	13.2	25.2
1977	19.2	25.2	22.8	20.4	36.0
1978	21.6	31.2	30.0	24.0	42.0
1979	28.8	32.4	28.8	25.2	50.4
1980	26.4	22.5	20.4	18.0	36.0
SEPARATIONS					
1966	30.8	31.5	28.1	31.0	46.9
1967	34.0	32.2	27.9	34.1	43.9
1968	45.4	32.3	30.2	31.3	41.1
1969	46.6	33.2	30.6	32.3	42.4
1970	48.7	41.7	43.8	32.1	47.4
1971	37.2	36.0	32.4	34.8	50.4
1972	19.2	24.0	21.6	18.0	33.6
1973	24.0	25.2	22.8	21.6	37.2
1974	22.8	22.8	20.4	19.2	34.8
1975	18.0	26.4	26.4	22.8	32.4
1976	18.0	21.6	20.4	15.6	31.2
1977	18.0	21.6	21.6	15.6	27.6
1978	18.0	18.0	15.6	14.4	30.0
1979	18.0	20.4	19.8	15.6	34.8
1980	15.6	19.2	15.6	15.6	32.4

[illegible]

WORK STOPPAGES
AIRCRAFT AND PARTS INDUSTRY
Calendar Years 1966-1979

Year	Number of Strikes	Number of Workers Involved	Man Days Idle in Year
1966	23	36,000	204,000
1967	22	26,800	160,800
1968	36	47,500	694,300
1969	26	26,400	1,264,600
1970	52	9,800	452,500
1971	24	17,200	269,500
1972	18	2,800	148,100
1973	19	4,500	44,700
1974	27	16,600	370,000
1975	25	22,800	1,245,600
1976	27	13,100	330,500
1977	21	46,700	1,832,200
1978	17	13,700	731,200
1979	12	6,900	193,400

OCCUPATIONAL INJURY AND ILLNESS INCIDENCE RATES
AEROSPACE AND ALL MANUFACTURING INDUSTRIES
Calendar Years 1971-1979

Year	All Manufacturing	Aircraft & Parts	Guided Missiles, Space Vehicles & Parts
1971	10.1	NA	NA
1972	10.9	8.7	4.7
1973	11.9	11.9	3.1
1974	10.1	9.5	4.1
1975	9.2	6.4	3.8
1976	9.8	6.1	2.1
1977	9.7	6.1	3.0
1978	10.3	6.9	4.4
1979	10.3	7.1	3.1

EMPLOYMENT IN THE AIRCRAFT AND PARTS INDUSTRY

Calendar Years 1966-1980
(Thousands of Employees)

Year	TOTAL	Aircraft (Airframes)	Aircraft Engines and Parts	Other Aircraft Parts and Equipment
TOTAL EMPLOYMENT				
1966	[illegible]	[illegible]	[illegible]	[illegible]
1967	[illegible]	[illegible]	[illegible]	[illegible]
1968	[illegible]	[illegible]	[illegible]	[illegible]
1969	[illegible]	[illegible]	[illegible]	[illegible]
1970	[illegible]	[illegible]	[illegible]	[illegible]
1971	[illegible]	[illegible]	[illegible]	[illegible]
1972	[illegible]	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]
1975	[illegible]	[illegible]	[illegible]	[illegible]
1976	[illegible]	[illegible]	[illegible]	[illegible]
1977	[illegible]	[illegible]	[illegible]	[illegible]
1978	[illegible]	[illegible]	[illegible]	[illegible]
1979	[illegible]	[illegible]	[illegible]	[illegible]
1980	[illegible]	[illegible]	[illegible]	[illegible]
PRODUCTION WORKERS				
1966	[illegible]	[illegible]	[illegible]	[illegible]
1967	[illegible]	[illegible]	[illegible]	[illegible]
1968	[illegible]	[illegible]	[illegible]	[illegible]
1969	[illegible]	[illegible]	[illegible]	[illegible]
1970	[illegible]	[illegible]	[illegible]	[illegible]
1971	[illegible]	[illegible]	[illegible]	[illegible]
1972	[illegible]	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]
1975	[illegible]	[illegible]	[illegible]	[illegible]
1976	[illegible]	[illegible]	[illegible]	[illegible]
1977	[illegible]	[illegible]	[illegible]	[illegible]
1978	[illegible]	[illegible]	[illegible]	[illegible]
1979	[illegible]	[illegible]	[illegible]	[illegible]
1980	[illegible]	[illegible]	[illegible]	[illegible]

EARNINGS IN AIRCRAFT AND PARTS PLANTS

Production Workers Only
(Includes Overtime Premiums)
Calendar Years 1966–1980

Year	TOTAL	Aircraft (Airframes)	Aircraft Engines and Parts	Other Aircraft Parts and Equipment
AVERAGE HOURLY EARNINGS				
1966	$ 3.31	$ 3.34	$ 3.32	$ 3.21
1967	3.45	3.49	3.42	3.35
1968	3.62	3.64	3.65	3.53
1969	3.86	3.90	3.87	3.76
1970	4.11	4.17	4.10	3.99
1971	4.35	4.41	4.38	4.16
1972	4.62	4.65	4.72	4.42
1973	4.99	5.09	5.04	4.70
1974	5.41	5.57	5.41	5.05
1975	6.00	6.20	6.04	5.48
1976	6.45	6.64	6.46	5.95
1977	6.92	7.07	7.05	6.44
1978r	7.54	7.70	7.80	6.93
1979r	8.26	8.50	8.53	7.46
1980	9.27	9.66	9.42	8.32
AVERAGE WEEKLY EARNINGS				
1966	$143.32	$142.95	$144.09	$142.85
1967	146.97	147.28	145.35	146.73
1968	152.04	152.88	151.11	151.44
1969	161.35	163.41	158.28	159.05
1970	168.51	170.97	166.05	166.78
1971	175.82	178.76	173.53	170.98
1972	185.26	180.89	193.52	186.52
1973	202.10	199.52	210.17	200.22
1974	220.19	221.69	221.81	213.62
1975	247.80	256.06	247.04	229.06
1976	264.45	273.57	259.69	245.74
1977	289.95	296.23	291.87	273.70
1978r	318.19	324.17	325.26	298.68
1979r	351.05	359.55	360.82	321.53
1980	388.96	403.67	392.91	355.20

Source: Bureau of Labor Statistics, "Employment and Earnings" (Monthly)
r Revised

EMPLOYMENT OF SCIENTISTS AND ENGINEERS[a] FOR RESEARCH AND DEVELOPMENT

Total and Aerospace
1960–1980

Year	TOTAL	Aerospace	Aerospace as a Percent of Total
AS OF JANUARY			
1960	292,000	72,400	24.8%
1961	312,100	78,500	25.2
1962	312,000	79,400	25.4
1963	327,300	90,700	27.7
1964	340,200	101,100	29.7
1965	343,600	99,200	28.9
1966	353,200	99,300	28.1
1967	367,200	100,400	27.3
1968	376,700	101,100	26.8
1969	387,100	99,700	25.8
1970	384,200	92,200	24.0
1971	367,000	78,200	21.3
1972	350,200	70,800	20.2
1973	357,700	72,100	20.2
1974	360,000	70,600	19.6
1975	363,300	67,500	18.6
1976	364,400	66,900	18.4
1977	382,800	72,000	18.8
1978	403,700	82,000	20.3
1979	423,500[r]	86,500[r]	20.4[r]
1980	451,700	88,200	19.5

Source: National Science Foundation.
a Scientists and engineers working less than full time have been included in terms of their full time equivalent number.
r Revised.

EMPLOYMENT IN NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PROGRAMS

End of Fiscal Years 1960–1982

Year	TOTAL	NASA Employees	Contractor Employees[E]
1960	46,768	10,268	36,500
1961	74,577	17,077	57,500
1962	137,656	22,156	115,500
1963	246,304	27,904	218,400
1964	379,084	31,984	347,100
1965	409,900	33,200	376,700
1966	393,924	33,924	360,000
1967	306,926	33,726	273,200
1968	267,871	32,471	235,400
1969	218,345	31,745	186,600
1970	160,850	31,350	129,500
1971	143,578	29,478	114,100
1972	138,800	27,500	111,300
1973	134,850	26,850	108,000
1974	125,220	25,020	100,200
1975	127,733	24,333	103,400
1976	130,739	24,039	108,000
1977	124,136	23,636	100,500
1978	124,637[r]	23,237	101,400[r]
1979	131,931	22,831	109,100
1980	135,613	22,613	113,000
1981[E]	133,473	21,873[r]	111,600
1982[E]	131,973	21,873	110,100

Source: NASA Briefing on the Budget of the United States (Annually)
E Estimate
r Revised

FINANCE

The aerospace industry's financial position remained strong in 1980 with a net profit after taxes of more than $2.5 billion, only slightly below the peak profit of 1979.

The 1980 profit, however, was realized from a sales level substantially higher than that of the previous year. Thus, the rate of profit, measured as a percentage of sales—4.2 percent—was well below the all-time high of five percent recorded in 1979.

The decline was consistent with the experience of other U.S. industries in a year of high inflation and high interest rates. The averge profit for all U.S. manufacturing corporations amounted to 4.9 percent in 1980, down from 5.7 percent in 1979. The average for producers of non-durable goods was 5.6 percent (down from 6.1 percent) and for durable goods manufacturers four percent (down from 5.2 percent).

One major factor in the aerospace profit dip was high interest rates on borrowings necessary to finance new plant and equipment expenditures, particularly the large investment in production facilities for the new generation of commercial transport aircraft. Aerospace outlays for plant and equipment amounted to $7 billion

in 1980, one-third greater than in the previous year. The 1980 figure compares with investments of less than $1 billion annually in the early years of the 1970s, when interest rates were one-half to one-third those of 1980.

Despite the decline in the aerospace profit rate for 1980 the percentage was significantly higher than in most years of the prior decade. From 1970 through 1975, the industry's profit rate never reached three percent and averaged less than 2.5 percent. The figure climbed to 3.4 percent in 1976 and since then has averaged better than 4.4 percent.

A principal reason for the upward trend, according to industry analysts, was a changing ratio of government/non-government business during the decade of the seventies. At the start of the decade, sales of aerospace products and services to the federal government amounted to approximately two-thirds of the total. Thereafter, government sales gradually declined as a percentage of the total, the decline becoming more pronounced in the latter seventies. Although government sales still comprise the larger part of the total, the mix now approaches the 50-50 level. Since non-government sales usually generate higher earnings, the changing mix has elevated the overall profit rate.

The aerospace balance sheet for 1980 showed increases in total assets —up $7.5 billion from the 1979 level to $52 billion—and in net worth—up $1.5 billion to $16.8 billion. Net working capital increased from $6.3 billion in 1979 to $7.2 billion in 1980.

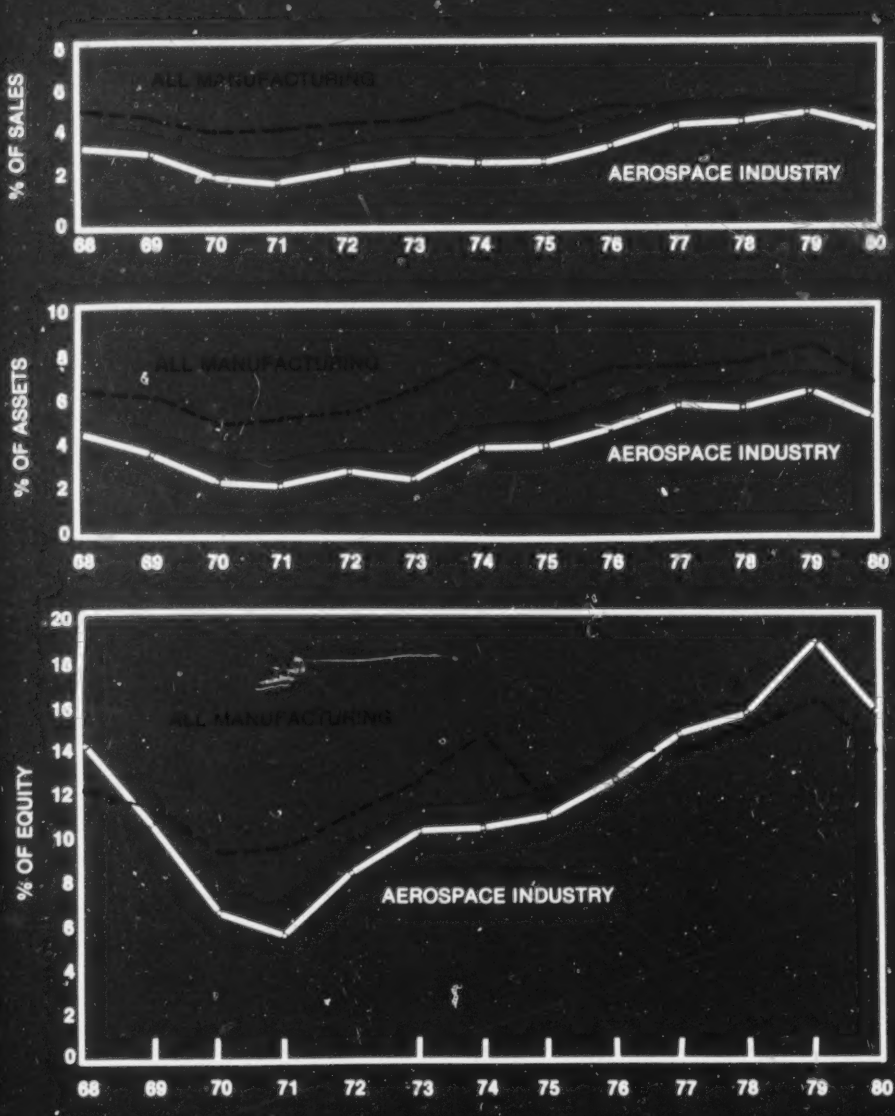
In terms of Fiscal Year 1980 contract dollar value, General Dynamics Corporation headed the list of companies awarded Department of Defense contracts. Others, in order of contract value, included McDonnell Douglas Corporation, United Technologies Corporation, The Boeing Company, General Electric Company, and Lockheed Corporation. The top three ranked the same as in the previous year.

The list of leading NASA contractors was topped by Rockwell International Corporation, followed by Martin Marietta Corporation, McDonnell Douglas Corporation, General Electric Company, Computer Sciences Corporation, Bendix Corporation, and IBM Corporation.

A geographical breakdown of major FY 1980 contracts for defense hard goods shows that the New England area led in production of aircraft-related hardware with 25.2 percent of the total dollar value. The West South Central are placed second with 18.2 percent and West North Central was third at 16.9 percent.

In contracts for missile and space systems, the Pacific area led by a wide margin with 52.5 percent. New England (13.1 percent) was second and the South Atlantic area third (8.3 percent). Pacific contractors, with 30.3 percent of the total, also led in production of electronics and communications equipment, followed by the Middle Atlantic (18.2 percent) and the South Atlantic (17 percent).

NET PROFIT AFTER TAXES



NET PROFIT AFTER TAXES AS A PERCENT OF SALES FOR MANUFACTURING CORPORATIONS

Calendar Years 1960–1980

Year	All Manufacturing Corporations	Non-Durable Goods	Durable Goods	Aerospace[1]
1960	4.4	4.3	4.0	1.4
1961	4.3	4.7	3.9	1.3
1962	4.5	4.7	4.3	2.4
1963	4.7	4.9	4.5	2.1
1964	5.2	5.4	5.1	2.5
1965	5.6	5.5	5.7	3.2
1966	5.6	5.5	5.6	3.0
1967	5.0	5.3	4.9	2.7
1968	5.1	5.3	4.9	3.2
1969	4.8	5.0	4.5	3.0
1970	4.0	4.5	3.5	2.0
1971	4.1	4.5	3.6	1.8
1972	4.4	4.7	4.2	2.4
1973	4.7	5.0	4.5	2.9
1974	5.5	6.4	4.7	2.9
1975	4.6	5.1	4.1	2.9
1976	5.4	5.5	5.2	3.4
1977	5.1	5.3	5.0	4.2
1978	5.4	5.4	5.5	4.4
1979	5.7	6.1	5.2	5.0
1980	4.9	5.6	4.0	4.2

Source: Federal Trade Commission, Quarterly Financial Report for Manufacturing, Mining and Trade Corporations.

[1] Based on sample of companies in entities classified in SIC pages 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, and parts.

INCOME ACCOUNTS
AEROSPACE COMPANIES

Calendar Years 1976-1980
(Millions of Dollars)

	1976	1977	1978	1979[r]	1980
Net Sales	$31,828	$34,307	$41,689	$51,801	$60,207
Income from Operations	1,874	2,338	3,023	3,606	3,603
Total Income before Income Taxes	1,649	2,296	2,726	3,711	3,460
Provision for Federal Income Taxes	694	1,003	1,154	1,489	1,296
As a Percent of Total Income	42.1%	43.7%	42.3%	40.1%	37.5%
Net Profit after Taxes	1,091	1,427	1,816	2,614	2,558
As a Percent of Net Sales	3.4%	4.2%	4.4%	5.0%	4.2%
Net Profit Retained in Business	750	1,012	1,255	1,897	1,757

Source: Federal Trade Commission, "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."

NOTE: Based on sample of corporate entities classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, and parts.

r Revised.

BALANCE SHEET
AEROSPACE COMPANIES

December 31, 1976-1980
(Millions of Dollars)

	1976	1977	1978	1979r	1980
Assets:					
Current Assets					
Cash	$ 765	$ 2,138	$ 2,696	$ 3,001	$ 1,907
U.S. Government Securities	79	31	119	79	473
Other Securities	810	1,097	1,077	564	414
Total Cash and U.S. Government Securities	$ 1,654	$ 3,267	$ 3,894	$ 3,645	$ 2,793
Receivables (Total)	3,088	3,564	4,475	5,237	5,905
Inventories (Gross)	10,779	10,568	15,986	20,491	26,358
Other Current Assets	516	677	840	844	830
Total Current Assets	$16,037	$18,075	$25,195	$30,217	$35,886
Net Plant, Property & Equipment	4,149	4,320	5,639	7,261	9,296
Other Non-Current Assets	3,693	3,705	5,144	7,041	6,903
Total Assets	$23,879	$26,100	$35,978	$44,518	$52,085
Liabilities:					
Current Liabilities					
Short Term Loans	$ 152	$ 279	$ 171	$ 698	$ 1,162
Advances by U.S. Govt.	3,233	1,886	5,400	6,554	8,899
Trade Accts. & Notes Payable	1,814	2,757	3,296	4,266	5,046
Income Taxes Accrued	938	1,779	2,088	2,742	2,755
Installments Due on Long Term Debts	434	307	249	272	168
Other Current Liabilities	4,350	4,612	7,940	9,342	10,651
Total Current Liabilities	$10,920	$11,621	$19,144	$23,873	$28,679
Long Term Debt	3,554	4,117	3,637	3,975	4,488
Other Non-Current Liabilities	398	496	1,016	1,356	2,123
Total Liabilities	$14,872	$16,233	$23,798	$29,204	$35,291
Stockholders' Equity:					
Capital Stock	$ 3,255	$ 3,452	$ 3,864	$ 5,013	$ 5,204
Earned Surplus and Reserves	5,753	6,415	8,315	10,301	11,590
Total Net Worth	$ 9,007	$ 9,866	$12,180	$15,315	$16,794
Total Liabilities and Stockholders' Equity	$23,879	$26,100	$35,978	$44,518	$52,085
Net Working Capital:	$ 5,118	$ 6,454	$ 6,051	$ 5,344	$ 7,207

Source: Federal Trade Commission, "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."

NOTE: Based on sample of corporate entities classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, and parts.

r Revised.

NEW PLANT AND EQUIPMENT EXPENDITURES

Calendar Years 1960–1981
(Billions of Dollars)

Year	Total Nonfarm Business	All Manufacturing Industries	Durable Goods	Aerospace
1960	$ 48.63	$ 16.36	$ 8.28	$ 0.34
1961	47.82	15.53	7.43	0.30
1962	51.28	16.03	7.81	0.40
1963	53.25	17.27	8.64	0.44
1964	61.66	21.23	10.98	0.41
1965	70.43	25.41	13.49	0.53
1966	82.22	31.37	17.23	1.17
1967	83.42	32.25	17.83	1.25
1968	88.45	32.34	17.93	1.23
1969	99.52	36.27	19.97	1.29
1970	105.61	36.99	19.80	0.88
1971	108.53	33.60	16.78	0.63
1972	120.25	35.42	18.22	0.68
1973	137.70	42.37	22.75	0.87
1974	156.98	53.21	27.44	1.51
1975	157.71	54.92	26.33	1.68
1976	171.45	59.95	28.47	1.69
1977	198.08	69.22	34.04	2.01
1978[r]	231.24	79.72	40.43	3.22
1979[r]	270.46	98.68	51.07	5.27
1980[r]	295.63	115.81	58.91	7.03
1981[E]	325.72	129.85	66.47	7.62

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Quarterly Report.
NOTE: A comprehensive revision of new plant and equipment expenditure data for 1947-1977 was completed by the BEA in 1980, with results showing P&E expenditures to be substantially higher and growing at a faster rate than the previously published data. The revision also expands coverage from "All Industries" to "Total Nonfarm Business" with the inclusion of four service industries.
r Revised.
E Estimate.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION MAJOR CONTRACTORS

Fiscal Years 1976-1980
By rank according to net value of NASA prime contracts awarded during last fiscal year
(Millions of Dollars)

Company	1976	1977	1978	1979	1980
TOTAL PROCUREMENTS	$3,205	$3,532	$3,660	$4,212	$4,843
Awards to Business Firms	2,536	2,838	2,954	3,417	3,868
Percent of TOTAL PROCUREMENTS	79%	80%	81%	81%	80%
Rockwell International Corp.	906	1,011	890	1,072	1,273
Martin Marietta Corp.	110	119	145	178	233
McDonnell Douglas Corp.	125	139	140	114	160
General Electric Co.	61	69	69	121	114
Computer Sciences Corp.	29	41	66	93	112
Bendix Corp.	75	91	95	100	97
IBM Corp.	43	66	73	93	84
Thiokol Corp.	47	62	68	78	79
United Technologies Corp.	18	34	51	73	75
Hughes Aircraft Co.	48	39	73	71	68
Boeing Services International	5	16	43	58	59
Lockheed Engrg. & Mgmt. Co.	56	68	75	51	59
Ford Aerospace & Commun.	20	26	30	35	48
Lockheed Missiles & Space Co.	9	10	21	36	47
General Dynamics Corp.	76	79	64	47	46
Boeing Company	55	53	43	43	45
Perkins Elmer Corp.	2	[a]	17	31	43
United Space Boosters Inc.	[a]	4	18	33	43
TRW Inc.	45	29	20	29	42
Planning Research Corp.	22	26	29	35	38
RCA Corp.	47	42	53	51	32
Pan American World Airways	7	12	12	27	32
Singer Co.	15	21	20	27	28
Lockheed Corp.	11	18	10	19	25
Kenton International Inc.	4	4	4	14	23
Northrop Services Inc.	17	19	16	20	22
Ball Corp.	10	8	18	22	21
Teledyne Industries Inc.	10	14	9	13	20
General Motors Corp.	[a]	3	6	11	20
Comp. Sciences Tech. Assoc.	11	11	14	16	18

Source: National Aeronautics and Space Administration, "NASA Annual Procurement Report," (Annually)
a Not in list of major contractors for indicated years

DEPARTMENT OF DEFENSE MAJOR CONTRACTORS

Fiscal Years 1976–1980
Listed by rank according to net value of prime contracts awarded during last fiscal year[a]
(Millions of Dollars)

Company	1976	1977	1978	1979	1980
TOTAL CONTRACTS	$41,976	$50,385	$59,582	$63,252	$76,807
General Dynamics Corp.	1,073	1,372	4,154	3,492	3,518
McDonnell Douglas Corp.	2,465	2,574	2,863	3,229	3,247
United Technologies Corp.	1,233	1,585	2,400	2,554	3,109
Boeing Co.	1,176	1,580	1,525	1,515	2,385
General Electric Co.	1,347	1,520	1,786	2,042	2,202
Lockheed Corp.	1,510	1,673	2,226	1,797	2,037
Hughes Aircraft Co.	911	1,093	1,489	1,557	1,819
Raytheon Co.	784	1,041	1,307	1,249	1,745
Tenneco Inc.	768	745	407	1,093	1,524
Grumman Corp.	982	1,428	1,180	1,364	1,322
Northrop Corp.	1,480	1,047	586	800	1,227
Motor Oil Hellas	[b]	[b]	[b]	184	1,059
Chrysler Corp.	469	620	743	809	971
Rockwell International Corp.	966	1,480	890	684	969
Westinghouse Electric Corp.	482	802	539	660	932
Sperry Corp.	506	652	612	778	845
FMC Corp.	418	245	361	352	835
Martin Marietta Corp.	249	426	539	519	809
Honeywell Inc.	386	457	545	658	687
Litton Industries, Inc.	978	609	1,557	832	652
AT&T Co.	447	457	457	570	597
RCA Corp.	330	364	565	487	589
Textron Inc.	372	455	868	477	579
Fairchild Industries, Inc.	227	429	508	505	559
LTV Corp.	316	296	384	448	511
General Motors Corp.	345	380	420	449	509
TRW Inc.	292	361	325	437	508
IBM Corp.	256	547	396	553	497
Exxon Corp.	245	238	311	341	480
Standard Oil Co. of CA.	281	297	244	241	475

Source: Department of Defense, "100 Companies and Their Subsidiary Corporations Listed According to Net Value of Prime Contract Awards." (Annually)

a Fiscal Year 1980 data include DOD contract awards for civil functions for the first time, while data for prior years are limited to military prime contract awards.

b Not in top 100 companies for the listed year.

PRIME CONTRACT AWARDS OF $10,000 OR MORE[a] FOR SELECTED MAJOR MILITARY HARD GOODS

By Geographic Region
Fiscal Years 1978, 1979, 1980

Program and Region	Millions of Dollars			Percent of Program Total		
	1978	1979	1980	1978	1979	1980
AIRCRAFT—TOTAL	$13,372	$13,259	$15,142	100.0%	100.0%	100.0%
New England	2,877	3,198	3,812	21.5	24.1	25.2
Middle Atlantic	1,952	2,042	2,241	14.6	15.4	14.8
East North Central	785	747	1,034	5.9	5.6	6.8
West North Central	2,210	2,728	2,551	16.5	20.6	16.9
South Atlantic	821	801	868	6.1	6.0	5.7
East South Central	97	113	169	0.7	0.9	1.1
West South Central	3,118	2,208	2,755	23.3	16.7	18.2
Mountain	124	146	146	0.9	1.1	1.0
Pacific[b]	1,388	1,276	1,566	10.4	9.6	10.3
MISSILE & SPACE SYSTEMS—TOTAL	$ 7,572	$ 7,620	$ 9,321	100.0%	100.0%	100.0%
New England	1,010	938	1,220	13.3	12.3	13.1
Middle Atlantic	683	546	596	9.0	7.2	6.4
East North Central	163	187	154	2.2	2.5	1.7
West North Central	632	592	694	8.3	7.8	7.4
South Atlantic	506	613	772	6.7	8.1	8.3
East South Central	173	126	145	2.3	1.6	1.6
West South Central	146	202	273	1.9	2.7	2.9
Mountain	505	449	572	6.7	5.9	6.1
Pacific[b]	3,754	3,967	4,895	49.6	52.1	52.5
ELECTRONICS & COMMUNICATIONS EQUIPMENT—TOTAL	$ 7,437	$ 8,953	$10,619	100.0%	100.0%	100.0%
New England	652	698	1,086	8.8	7.8	10.2
Middle Atlantic	1,322	1,870	1,936	17.8	20.9	18.2
East North Central	474	572	686	6.4	6.4	6.5
West North Central	464	490	879	6.2	5.5	8.3
South Atlantic	1,211	1,575	1,800	16.3	17.6	17.0
East South Central	33	38	58	0.5	0.4	0.5
West South Central	538	581	581	7.2	6.5	5.5
Mountain	278	310	371	3.7	3.5	3.5
Pacific[b]	2,465	2,819	3,222	33.1	31.5	30.3

Source: Department of Defense, "Prime Contract Awards by Region and State," (Annually).

a Fiscal year 1980 data include DOD contract awards for civil functions for the first time, while data for prior years are limited to military prime contract awards.

b Includes Alaska and Hawaii.

PRIME CONTRACT AWARDS OF $10,000 OR MORE[a] FOR RESEARCH, DEVELOPMENT, TEST & EVALUATION

By Region and Type of Contractor
Fiscal Year 1980
(Millions of Dollars)

REGION	TOTAL	Type of Contractor		
		Educational Institutions	Other Non-Profit Institutions[b]	Business Firms
TOTAL—Millions of Dollars	$9,354	$652	$510	$8,192
New England	1,188	178	178	832
Middle Atlantic	912	56	14	842
East North Central	451	42	19	390
West North Central	1,032	6	1	1,025
South Atlantic	1,352	228	75	1,049
East South Central	229	4	2	223
West South Central	293	22	10	261
Mountain	489	30	1	458
Pacific[c]	3,408	85	211	3,112
PERCENT OF TOTAL	100.0%	100.0%	100.0%	100.0%
New England	12.7	27.3	34.9	10.1
Middle Atlantic	9.8	8.5	2.7	10.3
East North Central	4.8	6.5	3.6	4.8
West North Central	11.0	1.0	0.2	12.5
South Atlantic	14.5	35.0	14.7	12.8
East South Central	2.5	0.6	0.4	2.7
West South Central	3.1	3.4	1.9	3.2
Mountain	5.2	4.6	0.3	5.6
Pacific[c]	36.4	13.1	41.3	38.0

Source: Department of Defense, "Prime Contract Awards by Region and State" (Annually).

a Fiscal year 1980 data include DOD contract awards for civil functions for the first time, while data for prior years were limited to military prime contract awards.

b Includes contracts with other government agencies.

c Includes Alaska and Hawaii.

GLOSSARY

Accessions: see **Labor Turnover.**

Aeronautics: the science that treats of the operation of aircraft, also, the art or science of operating aircraft.

AIA: Aerospace Industries Association of America, Inc., formerly Aircraft Industries Association.

Aerospace Industry: the industry engaged in research, development and manufacture of aerospace systems, including manned and unmanned aircraft; missiles, space launch vehicles, and spacecraft; propulsion, guidance and control units for all of the foregoing; and a variety of airborne and ground based equipment essential to the test, operation, and maintenance of flight vehicles.

Aerospace Employment: annual average calculated as one-twelfth of sum of monthly estimates of total number of persons employed during a designated pay period by the aircraft and missile and space industries (SIC 372 and 376) plus estimated aerospace-related employment in the communications (SIC 3662) and instruments (SIC 381 and 382) industries and in certain other industries (SIC 28, 35, 73, 89, etc.).

Aerospace Payroll: estimated on the basis of average weekly earnings for a given calendar year for production workers plus an estimated annual salary for other employees.

Aerospace Sales: the AIA estimate of aerospace industry sales, developed by summing the (1) DOD expen-

ditures for procurement of aircraft and missiles; (2) estimates of DOD expenditures for RDT&E of aircraft and missiles; (3) NASA expenditures for research and development; (4) outlays for space activities by other U.S. Government departments and agencies; (5) net sales of aerospace products to other than U.S. Government; and (6) non-aerospace sales of major aerospace companies.

Air Carriers: the commercial system of air transportation, consisting of scheduled domestic and international air carriers, air taxis, air cargo operators and supplemental air carriers.

Aircraft: all airborne vehicles supported either by buoyancy or by dynamic action. Used in this volume in a restricted sense to mean an airplane — any winged aircraft, including helicopters but excluding gliders and guided missiles.

Aircraft Agreement (Agreement on Trade in Civil Aircraft): negotiated in the Tokyo Round of the Multilateral Trade Negotiations, and implemented January 1, 1980, providing for elimination of tariff and non-tariff trade barriers in the civil aircraft sector.

Aircraft Industry: the industry primarily engaged in the manufacture of aircraft, aircraft engines and parts, aircraft propellers and parts, and aircraft parts and auxiliary equipment. A sector of the **U erospace industry.**

Airframe: the structural components of an airplane, such as fuselage, empennage, wings, landing gear, and engine mounts, but excluding such items as engines, accessories, electronics and other parts that may be replaced from time to time.

Airlines: see **Air Carriers.**

Appropriation (Federal Budget): an act of Congress authorizing an agency to incur obligations and make payments out of funds held by the Department of the Treasury.

Assets, Net: the sum of all recorded assets after reducing such amount by allowance of reserve for bad debts, depreciation and amortization, but before deducting any liabilities, mortgages or other indebtedness.

Astronautics: the art and science of designing, building and operating manned or unmanned space objects.

Average Weekly Hours: average hours for which pay was received; different from standard of scheduled hours.

Backlog: the sales value of orders accepted (supported by legal documents) that have not yet passed through the sales account.

Budget Authority: authority provided by the Congress, mainly in the form of **Appropriations**, which allows Federal agencies to incur obligations to spend or lend money.

Bureau of the Census: an agency of the Department of Commerce.

Bureau of Economic Analysis (BEA): an agency of the Department of Commerce.

Bureau of Labor Statistics (BLS): an agency of the Department of Labor.

Constant Dollars, see **Deflators.**

Deflators (Constant Dollars): used to reduce a price level to that comparable with the price level at a given different time, offsetting the effect of inflation. The Gross National Product in constant dollars is arrived at by dividing components of the current dollar figures by appropriate price deflators.

Depreciation: the general conversion of the depreciable cost of a fixed asset into expense, spread over its remaining life. There are a number of methods, all based on a periodic charge to an expense account and a corresponding credit to a reserve account.

Development: the process or activity of working out a basic design, idea or piece of equipment (see **Research**).

DOD: Department of Defense.

DOE: Department of Energy.

DOT: Department of T ansportation.

Durable Goods Industry: comprised of major manufacturing industry groups with SIC Codes 24, 25, and 32-39. All major manufacturing industry groups in SIC Codes 20-23 and 26-31 are considered nondurable goods manufacturing industry groups.

Earnings: the actual return to the worker for a stated period of time. Irregular bonuses, retroactive items, payments of various welfare benefits, and payroll taxes paid by employers are excluded.

Average Hourly Earnings: on a "gross" basis, reflecting not only changes in basic hours and incentive wage rates, but also such variable factors as premium pay for overtime and late shift work, and changes in output of workers paid for an incentive plan.

Average Weekly Earnings: derived by multiplying average weekly hours by hourly earnings.

ERDA: Energy, Research and Development Administration. ERDA was formed in 1974 to bring together activities previously scattered among several agencies. The major elements covered were nuclear energy, fossil energy, solar and geothermal energy, conservation through increased efficiency and environmental controls. Most of these functions were assumed by the Department of Energy as of October 1, 1977.

Establishment: the basis for reporting to the Census of Manufacturers; an operating facility in a single location.

Evaluation: (Department of Defense): determination of technical suitability of material, equipment or a system, see **RDT&E.**

Expenditures (Federal Budget): see **Outlays.**

Exports: domestic merchandise including commodities which are grown, produced, or manufactured in the United States, and commodities of foreign origin which have been changed in the United States from the form in which they were imported, or which have been enhanced in value by further manufacture in the United States, and which are traded or sold to other nations.

FAA: Federal Aviation Administration (formerly the Federal Aviation Agency), an agency of the Department of Transportation.

Facility: a physical plant or installation including real property, building, structures, improvements and plant equipment.

Fiscal Year (Federal Budget): until June 30, 1976, year beginning July 1 and ending June 30, and designated by the year in which it ends. Beginning October 1, 1976, the fiscal years run from October 1 through September 30. A three month **Transition Quarter** from July 1 through September 30, 1976, belongs to neither fiscal year.

Flyaway Value: includes the cost of the airframe, engines, electronics, communications, armament and other installed equipment.

Foreign Military Sales (FMS): export sales to foreign governments arranged through the Department of Defense, whereby DOD recovers full purchase price and administrative costs; often mistakenly used to include foreign military aid and foreign commercial sales as well.

FY: see **Fiscal Year.**

General Agreement on Tariffs and Trade GATT): a multilateral treaty, suscribed to by over 80 governments which together account for more than four-

fifths of world trade; its aim is to liberalize world trade; the only multilateral instrument that lays down agreed rules for international trade.

General Aviation: all civil flying except that of the trunk, regional and supplemental airlines.

GNP (Gross National Product): the market value of the total output of goods and services produced by the nation's economy before deduction of depreciation charges and other allowances for business and institutional consumption of durable goods. It includes the purchase of goods and services by consumers and government, gross private domestic investment and net exports.

Helicopter: a rotary-wing aircraft which depends principally for its support and motion in the air upon the lift generated by one or more power-driven rotors, rotating on substantially vertical axes. A helicopter is a V/STOL.

Heliport: an area, either at ground level or elevated on a structure, that is used for the landing and take-off of **helicopters** and includes some or all of the various facilities useful to helicopter operations such as helicopter parking, hangar, waiting room, fueling and maintenance equipment.

Helistop: a minimum facility **heliport,** either at ground level or elevated on a structure for the landing and takeoff of **helicopters** but without such auxiliary facilities as waiting room, hangar parking, etc.

ICBM: Intercontinental Ballistic Missile, with a range of more than 5,000 miles.

Imports: classified as "general imports" or "imports for consumption." This volume refers generally to "imports for consumption," which are entries for immediate consumption plus merchandise withdrawn from bonded storage warehouses for consumption. Data are compiled from Import Entries filed with U.S. Customs officials, and are in general based on the market value or price in the foreign country at the time of exportation of such merchandise, including the cost of containers and coverings, as well as other charges and expenses incidental to placing the merchandise in condition, packed and ready for shipment to the United States, but excluding import duties, insurance, freight and other charges incidental to arrival of the goods in the United States. The foreign values of imported merchandise are converted into U.S. currency at the rate of exchange prevailing on the day the merchandise is shipped to the United States.

Income:

Net Operating Income: total net sales (see **Sales**) less total operating costs.

Net Income (Before Income Taxes): Net Operating Income plus or minus **"Other Income and Expenses."**

Other Income and Expense: includes interest income, royalty income, capital gains and losses, interest expense, cash discounts, etc.

Net Income (After Income Taxes): Net Income (Before Taxes) less federal income taxes.

Labor Turnover: the gross movement of wage and salary workers into and out of employed status with respect to individual establishments. This movement is divided into two broad types: **Accessions** and **Separations.** Each type of action is accumulated for a calendar month or year and expressed as a rate per 100 employees. The data relate to all employees, full-or part-time, permanent or temporary

Accessions: the total number of permanent and temporary additions to the employment roll, including both new and rehired employees.

Separations: terminations of employment during the calendar month or year, classified according to cause: quits, layoffs, and other separations.

Man-Hours: in measuring labor input, takes into account both the number of production workers and their actual hours of work. The Bureau of Labor Statistics covers all hours paid for, whether worked or not, when the employee was at the plant. One man-hour means one hour of a person's time.

Manufacturing Industries: those **establishments** engaged in the mechanical or chemical transformation of inorganic or organic substances into new products, and usually described as plants, factories, or mills, which characteristically use power-driven machines and materials handling equipment; also establishments engaged in assembling component parts of manufactured products if the new product is neither a structure nor other fixed improvement.

Merchandise Trade Balance: the difference between the value of U.S. goods exported to other countries and foreign goods imported into this country. The trade balance is generally regarded as "favorable" when **exports** exceed **imports** — a trade surplus — and "unfavorable" when **imports** exceed **exports** — a trade deficit.

Military Assistance Programs (MAP): grant aid given to qualifying countries.

Missile: sometimes applied to space launch vehicles, but more properly connotes automated weapons of warfare, *i.e.* a weapon which has an integral system of guidance, as opposed to the unguided rocket.

Multilateral Trade Negotiations (MTN): a forum within the **GATT** in which countries negotiate to overcome their trade problems. In September 1973, in Tokyo, over 100 nations launched new multilateral trade negotiations, called the "Tokyo Round," covering both tariff and non-tariff barriers to trade in industrial and agricultural products, and improvements in the **GATT** itself.

NASA: National Aeronautics and Space Administration.

NATO: North Atlantic Treaty Organization.

New Obligational Authority (Federal Budget): see **Budget Authority.**

Non-Aerospace Products and Services: includes all non-aircraft, non-space vehicle, and non-missile products and services produced or performed by those companies and/or establishments whose principal business is the development and/or production of aircraft, aircraft engines, missile and spacecraft engines, missiles and/or spacecraft.

OASD: Office of the Assistant Secretary of Defense.

Obligations (Federal Budget): commitments made by Federal agencies to pay out money for products, services or other purposes — as distinct from the actual payments. Obligations incurred may not be larger than budget authority.

Other Aerospace Products and Services: all conversions, modifications, site activation, other aerospace products (including drones) and services, basic and applied research in the sciences and in engineering, and design and development of prototype products and processes.

Outlays: checks issued, interest accrued on the public debt, or other payments made, net of refunds and reimbursements.

Overtime Hours: that portion of the gross average weekly hours which was in excess of regular hours and for which premium payments were made.

Payroll: includes the gross earnings paid in the calendar year to all employees on the payroll of operating manufacturing **establishments.** Includes all forms of compensation paid directly to workers such as salaries, wages, commissions, dismissal pay, all bonuses, vacation and sick leave pay, and compensation in kind, prior to such deductions as employees' Social Security contributions, withholding taxes, group insurance, union dues, and savings bonds. Does not include employers' Social Security contributions or other non-payroll labor costs such as employees' pension plans, group insurance premiums, and workmen's compensation.

Passenger-Mile: one passenger moved one mile.

Procurement: the process whereby the executive agencies of the Federal Government acquire goods and services from enterprises other than the Federal Government.

Production Workers: includes working foremen and all non-supervisory workers (including leadmen and trainees) engaged in fabricating, processing, assembling, inspection, receiving, storage, handling, janitorial services, product development, auxiliary production for plant's own use and record keeping and services closely associated with the above production operations.

R&D: Research and Development

Research: systematic study directed toward fuller scientific knowledge or understanding of the subject studied. Research is classified as either **basic** or **applied** according to the objectives of the sponsoring agency.

Basic Research: with the objective of gaining fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

Applied Research: with the objective of gaining knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

Development: the systematic use of scientific knowledge directed toward the production of useful materials, devices, systems, or methods including design and development of prototype and processes.

RDT&E (Department of Defense): Research, Development, Test and Evaluation.

Research: see R&D

Rotorcraft: an aircraft which in all its usual flight attitudes is supported in the air wholly or in part by a rotor or rotors, *i.e.*, airfoils rotating or revolving about an axis (see **Helicopter**).

Sales: net of returns, allowances, and discounts; the dollar value of shipments less returns and allowances, including dealer's commission, if any, which have passed through the sales account.

Satellite: a body that revolves around a larger body, such as the moon revolving around the earth, or a man-made object revolving about any body such as the sun, earth, or moon.

Separation: see **Labor Turnover.**

SIC (Standard Industrial Classification): a system developed by the U.S. Government to define the industrial composition of the economy, facilitating comparability of statistics.

Space Vehicle: an artificial body operating in outer space (beyond the earth's atmosphere).

Stockholder's Equity: assets minus all

obligations of the corporation, except those to stockholders. Annual data are average equity for the year (using four end-of-quarter figures.) For details, see Federal Trade Commission's "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."

STOL: short take-off and landing aircraft.

Test (Department of Defense): an experiment designed to assess progress in attainment or accomplishment of development objectives (see **RDT&E**).

Thrust: the driving force exerted by an engine, particulary an aircraft or missile engine, in propelling the vehicle to which it is attached.

Ton-Mile: one ton moved one mile.

Total Obligational Authority: the sum of **budget authority** granted or requested from the Congress in a given year, plus unused **budget authority** from prior years.

Trade Balance: see **Merchandise Trade Balance.**

Transition Quarter (Tr. Qtr.): the three-month interval from July 1, 1976 to September 30, 1976. Beginning with the 1977 budget, the **fiscal year** (FY) runs from October 1 through September 30. To facilitate the conversion, this transition period was provided between FY 1976 and FY 1977 as a separate accounting period belonging to neither year.

Turbine, Turbo: a mechanical device or engine that spins in reaction to a fluid flow that passes through or over it. Frequently used in "turboprop" or "turbojet."

U.K.: United Kingdom.

U.S.: United States of America.

USA: United States Army, an agency of the U.S. Department of Defense.

USAF: United States Air Force, an agency of the U.S. Department of Defense.

USN: United States Navy, an agency of the U.S. Department of Defense.

USSR: Union of Soviet Socialist Republics.

Utility Aircraft: an aircraft designed for general purpose flying.

V/STOL: vertical short take-off and/or landing aircraft.

Wages: the payroll (see **Payroll**) of production and related workers.

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CCI Corporation
  The Marquardt Company
Colt Industries, Inc.
  Chandler Evans, Inc.
    Control Systems Division
  Menasco, Inc.
Criton Corporation
E-Systems, Inc.
FMC Corporation
  Ordnance Division
The Garrett Corporation
Gates Learjet Corporation
General Dynamics Corporation
General Electric Company
General Motors Company
  Detroit Diesel Allison Division
The BFGoodrich Company
  Engineered Products Group
Goodyear Aerospace Corporation
Gould Inc.
Grumman Corporation
Hercules Incorporated
Honeywell Inc.
Howmet Turbine Components Corp.
Hughes Aircraft Company
IBM Corporation
  Federal Systems Division
ITT Telecommunications & Electronics
  Group-North America
  ITT Aerospace/Optical Division
  ITT Avionics Division
  ITT Defense Communications Division
  ITT Gilfillan
Lear Siegler, Inc.
Lockheed Corporation
Martin Marietta Aerospace
McDonnell Douglas Corp.
Northrop Corporation
Parker Hannifin Corporation
Pneumo Corporation
  Cleveland Pneumatic Co.
  National Water Lift Co.
Raytheon Company
RCA Corporation
Rockwell International Corporation
Rohr Industries Inc.
The Singer Company
Sperry Corporation
Sundstrand Corporation
  Sundstrand Advanced Technology
    Group
Teledyne CAE
Textron Inc.
  Bell Aerospace Textron
  Bell Helicopter Textron
  Dalmo Victor Operations
  Hydraulic Research
Thiokol Corporation
TRW Inc.
United Technologies Corporation
Vought Corporation
Western Gear Corporation
Westinghouse Electric Corp.
  Public Systems Company
Wyman-Gordon Company